MOTOROLA

MITREK SYSTEMS 90

Channel Scan Monitor

Models HLN1002A, HLN1003A

Instruction Manual

68P81109E58-A

MODEL CHART

MITREK / SYSTEMS 90

"CHANNEL-SCAN" MONITOR

SUB-MODEL	SUFFIX	DESCRIPTION	MODEL	SUFFIX	DESCRIPTION	PRIORITY SELECT HLN1003A	NON-PRIORITY SELECT HLN1002A
HLN4042A		CIRCUIT BOARD				X	
HLN4043A		CIRCUIT BOARD					X
HKN4029A		CABLE KIT (YEL)				X	X
TKN6502A		CABLE KIT (YEL)				X	X
TLN4508A		HARDWARE KIT				X	
TLN4509A		HARDWARE KIT					X

EPS-27351-O

MOTOROLA INC.

instruction manual revision

SUPERSEDES SMR-4227

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81039E80	MITREK Two-Way FM Radio 450-512 MHz, 75/100 Watts
68P81040E80	MITREK Super CONSOLETTE Base Station
68P81045E65	MITREK Two-Way FM Radio 29.7-50 MHz, 60/110 Watts
68P81045E70	MITREK Two-Way FM Radio 136-174 MHz, 40/60/75/110 Watts
68P81045E75	MITREK Two-Way FM Radio 406-512 MHz, 30/50/75/100 Watts
68P81109E56	MITREK SYSTEMS 90 Alternate Control Module and Radio Cables
68P81109E57	MITREK SYSTEMS 90 Mobile Public Address
68P81109E58	MITREK SYSTEMS 90 Channel Scan Monitor

REVISION DETAILS:

All 1/4 watt, carbon composition, fixed resistors used in equipment covered in the above listed manuals are replaced with ±5%, 1/4 watt, carbon film, fixed resistors. Use the following cross-reference list to update the parts lists in your manual.

CROSS-REFERENCE LIST: Old vs New Resistor Part Numbers

Ohms (1/4 Watt)	Old Part Number Carbon Composition 10%	Old Part Number Carbon Composition 5%	New Part No. Carbon Film 5%
10	6-124C01	6-124A01	6-11009C01
11		6-124A02	6-11009C02
12	6-124C03	6-124A03	6-11009C03
13		6-124A04	6-11009C04
15	6-124C05	6-124A05	6-11009C05
16		6-124A06	6-11009C06
18	6-124C07	6-124A07	6-11009C07
20		6-124A08	6-11009C08
22	6-124C09	6-124A09	6-11009C09
24		6-124A10	6-11009C10
27	6-124C11	6-124A11	6-11009C11
30		6-124A12	6-11009C12
33	6-124C13	6-124A13	6-11009C13
36		6-124A14	6-11009C14
39	6-124C15	6-124E15	6-11009C15
43		6-124A16	6-11009C16
47	6-124C17	6-124A17	6-11009C17
51		6-124A18	6-11009C18
56	6-124C19	6-124A19	6-11009C19
62		6-124A20	6-11009C20
68	6-124C21	6-124A21	6-11009C21
75		6-124A22	6-11009C22
82	6-124C23	6-124A23	6-11009C23
91		6-124A24	6-11009C24
100	6-124C25	6-124A25	6-11009C25
110		6-124A26	6-11009C26
120	6-124C27	6-124A27	6-11009C27
130		6-124A28	6-11009C28
150	6-124C29	6-124A29	6-11009C29
160		6-124A30	6-11009C30
180	6-124C31	6-124A31	6-11009C31
200		6-124A32	6-11009C32
220	6-124C33	6-124A33	6-11009C33
240		6-124A34	6-11009C34
270	6-124C35	6-124A35	6-11009C35
300		6-124A36	6-11009C36
330	6-124C37	6-124A37	6-11009C37
360		6-124A38	6-11009C38
390	6-124C39	6-124A39	6-11009C39
430		6-124A40	6-11009C40
470	6-124C41	6-124A41	6-11009C41
510		6-124A42	6-11009C42
560	6-124C43	6-124A43	6-11009C43
620		6-124A44	6-11009C44
680	6-124C45	6-124A45	6-11009C45
750		6-124A46	6-11009C46
820	6-124C47	6-124A47	6-11009C47
910		6-124A48	6-11009C48
1k	6-124C49	6-124A49	6-11009C49

CROSS-REFERENCE LIST: Old vs New Resistor Part Numbers (Cont'd.)

Ohms (1/4 Watt)	Old Part Number Carbon Composition 10%	Old Part Number Carbon Composition 5%	New Part No. Carbon Film 5%
1.1k		6-124A50	6-11009C50
1.2k	6-124C51	6-124A51	6-11009C51
1.3k		6-124A52	6-11009C52
1.5k	6-124C53	6-124A53	6-11009C53
1.6k		6-124A54	6-11009C54
1.8k	6-124C55	6-124A55	6-11009C55
2.0k		6-124A56	6-11009C56
2.2k	6-124C57	6-124A57	6-11009C57
2.4k		6-124A58	6-11009C58
2.7k	6-124C59	6-124A59	6-11009C59
3.0k		6-124A60	6-11009C60
3.3k	6-124C61	6-124A61	6-11009C61
3.6k		6-124A62	6-11009C62
3.9k	6-124C63	6-124A63	6-11009C63
4.3k		6-124A64	6-11009C64
4.7k	6-124C65	6-124E65	6-11009C65
5.1k		6-124A66	6-11009C66
5.6k	6-124C67	6-124A67	6-11009C67
6.2k		6-124A68	6-11009C68
6.8k	6-124C69	6-124A69	6-11009C69
7.5k		6-124A70	6-11009C70
8.2k	6-124C71	6-124A71	6-11009C71
9.1k		6-124A72	6-11009C72
10k	6-124C73	6-124A73	6-11009C73
11k		6-124A74	6-11009C74
12k	6-124C75	6-124A75	6-11009C75
13k		6-124A76	6-11009C76
15k	6-124C77	6-124A77	6-11009C77
16k		6-124A78	6-11009C78
18k	6-124C79	6-124A79	6-11009C79
20k		6-124A80	6-11009C80
22k	6-124C81	6-124A81	6-11009C81
24k		6-124A82	6-11009C82
27k	6-124C83	6-124A83	6-11009C83
30k		6-124A84	6-11009C84
33k	6-124C85	6-124A85	6-11009C85
36k		6-124A86	6-11009C86
39k	6-124C87	6-124A87	6-11009C87
43k		6-124A88	6-11009C88
47k	6-124C89	6-124A89	6-11009C89
51k		6-124A90	6-11009C90
56k	6-124C91	6-124A91	6-11009C91
62k		6-124A92	6-11009C92
68k	6-124C93	6-124A93	6-11009C93
75k		6-124A94	6-11009C94
82k	6-124C95	6-124A95	6-11009C95
91k		6-124A96	6-11009C96
100k	6-124C97	6-124A97	6-11009C97
110k		6-124A98	6-11009C98

CROSS-REFERENCE LIST: Old vs New Resistor Part Numbers (Cont'd.)

Ohms (1/4 Watt)	Old Part Number Carbon Composition 10%	Old Part Number Carbon Composition 5%	New Part No. Carbon Film 5%
120k	6-124C99	6-124A99	6-11009C99
130k		6-124B01	6-11009D01
150k	6-124D02	6-124B02	6-11009D02
160k		6-124B03	6-11009D03
180k	6-124D04	6-124B04	6-11009D04
200k		6-124B05	6-11009D05
220k	6-124D06	6-124B06	6-11009D06
240k		6-124B07	6-11009D07
270k	6-124D08	6-124B08	6-11009D08
300k		6-124B09	6-11009D09
330k	6-124D10	6-124B10	6-11009D10
360k		6-124B11	6-11009D11
390k	6-124D12	6-124B12	6-11009D12
430k		6-124B13	6-11009D13
470k	6-124D14	6-124B14	6-11009D14
510k		6-124B15	6-11009D15
560k	6-124D16	6-124B16	6-11009D16
620k		6-124B17	6-11009D17
680k	6-124D18	6-124B18	6-11009D18
750k		6-124B19	6-11009D19
820k	6-124D20	6-124B20	6-11009D20
910k		6-124B21	6-11009D21
1 meg	6-124D22	6-124B22	6-11009D22

68P81109E49–C

SERVICE SHEET

MOTOROLA

MITREK® /Systems 90

MOBILE ACCESSORY GROUP

INSTALLATION INSTRUCTIONS

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3/21/79

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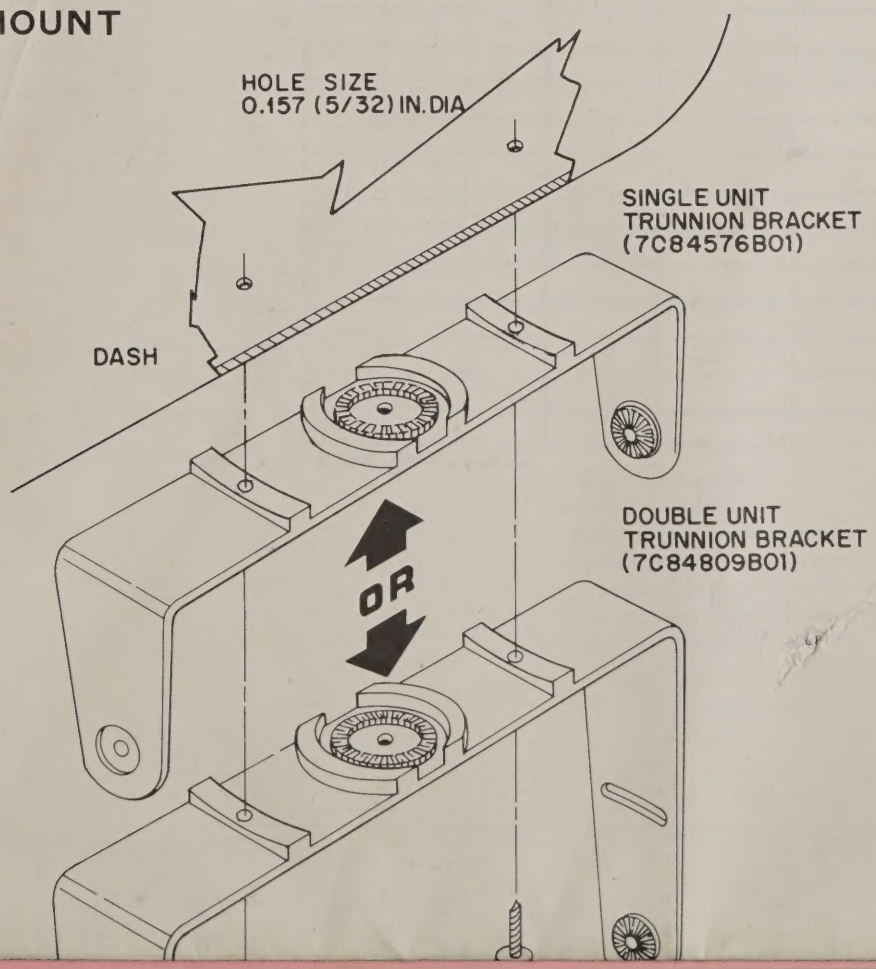
1301 E. ALGONQUIN RD.
SCHAUMBURG, ILLINOIS 60196

STEP 1 *TRUNNION MOUNT INSTALLATION*

SOLID MOUNT



IMPORTANT

READ THESE INSTRUCTIONS BEFORE USING THE INFORMATION ON THIS SHEET TO INSTALL YOUR EQUIPMENT.

NOTE

The mobile accessories are shipped from the factory completely interconnected. These instructions are only required if it is necessary to reassemble or add additional accessories.

I. Both the intercabling diagram and the interconnect chart contain similar information. It is recommended that the interconnect chart be used in less complex systems, i.e., one or two accessory modules. In more complex systems, BOTH the diagram and the chart should be used together.

II. The circles numbers, e.g. (9), refer to notes. Where a note is indicated, READ THE NOTE FIRST, then proceed with the installation.

III. Both the diagram and the chart are for negative ground installation.

IV. Before using the chart, familiarize yourself with the legend at the bottom. Where more than one accessory module has the same priority, either module may be connected first.

V. When using the diagram, always read the diagram from left to right. This will help you in establishing the proper priorities in multiple accessory systems. The BLK-BRN (discriminator) lead may be difficult to follow in some systems. Refer to the chart and notes for clarification, if needed.

VI. Where reference is made to MOBILE DECODERS, the "Quik Call I and II" and "Touch Code" Decoders are represented.

VII. It is recommended that only one module at a time, and only one wire at a time be installed. This will eliminate possible errors and confusion in the more complex system installations.

VIII. 1. When using QKN8481A, QKN8482A, or TKN6454A-SP700 Cable Kits, a slight modification will be required:

Open the connector housing and disconnect the brown lead from pin 14 and the black-yellow lead from pin 1. Reconnect the brown lead to pin 1 and the black-yellow lead to pin 14. Close up the connector.

2. Connections are the same as shown on this diagram with the following exception:

F1 FREQUENCY SELECT is a blue wire in these cable kits.

3. These cables are not positive ground compatible.

EPS-26347-A

POSITIVE GROUND INSTALLATIONS

ALTERNATE CONTROL MODULE

a. Use a positive ground Systems 90 control cable.
b. Remove and discard the Yel lead connecting the final accessory to ACM-1. If no System 90 accessories are used with the ACM, tie back the Yel lead from the radio.

CAUTION
The Yel lead is hot and must be taped securely.

c. Connect the Blu lead from the radio to ACM-1.

CHANNEL SCAN MONITOR YEL CONNECTOR

a. Exchange the Org leads at pins 1 and 4 of the small connector with the Blk-Org leads at pins 20 and 9 of the large connector.
b. Exchange the Yel leads at pins 3 and 5 of the small connector with the Blk-Vio leads at pin 6 of the small connector and pin 2 of the large connector.

MOBILE DECODERS GRN CONNECTOR

Exchange the Yel leads at pins 18 and 8 with the Blk-Vio leads at pins 13 and 2.

PUBLIC ADDRESS ORG CONNECTOR

Exchange the Yel leads at pins 12 and 1 with the Blk-Vio leads at pins 15 and 5.

VOICE PRIVACY ADAPTER RED CONNECTOR

Exchange the Yel leads at pins 12 and 1 with the Blk-Vio leads at pins 15 and 14.

MULTIPLE PL ENCODER TAN CONNECTOR

a. Exchange the Yel leads at pins 2 and 13 with the Blk-Vio leads at pins 1 and 12.
b. Interchange Org leads; move the lead at pin 8 to pin 15 and move the leads at pins 5 and 15 to pins 8 and 18 (some of these leads may not be present if ignition sense option is not incorporated).
c. Move the flexible wire jumper from point A to point B on the circuit board.

TOUCH-CODE ENCODER BLU CONNECTOR

Exchange the Yel leads at pins 16 and 6 with the Blk-Vio at pin 12 and the Blk-Wht lead at pin 1.

SIREN PINK CONNECTOR

SCM
a. Move Wht lead from pin 16 of pink connector to pin 21.
b. Move Org jumper on control board from staked pin 2 to staked pin 1.
c. Connect Yel jumper for the exact installation as outlined in the siren manual.

POWER AMPLIFIER
a. Exchange the Red and Blk leads (JU101 and JU102 on TB101-3 and 4 of the power amplifier).
b. Move JU103 (red) from pin 18 to pin 19.

SINGLE TONE ENCODER

Exchange the Yel leads at pins 19 and 9 with the Blk-Vio leads at pins 12 and 1.

EPS-26348-B

PRIORITY NOTES

ABBREVIATIONS:

MPL	Multiple PL Encoder	PAM	Public Address Module P3
STE	Single Tone Encoder	MD	Mobile Decoders
TCE	Touch Code Encoder	CSM	"Channel-Scan" Monitor P1
VPA	Voice Privacy Adapter	ACM	Alternate Control Module P101 →
SCM	Siren Control Module P1		

1 VOLUME

Blk-Grn Volume lead from radio must connect to mobile decoder and/or scan monitor before connection to PAM-19. Grn-Blk lead from PAM-8 connects to ACM-20.

2 DETECTED AUDIO (See detail A).

I. PAM without VPA
Blk-Brn lead from radio connects to PAM-9, from PAM-21 to PAM-18, Brn-Blk from PAM-7 connects to MD-15, and Blk-Brn from MD-5 to ACM-16.

II. VPA without PAM

Blk-Brn lead from radio connects MD-15, from MD-5 to VPA-3, and from VPA-2 to ACM-16. Brn-Blk lead (unscrambled receive audio) from VPA-16 connects to ACM-16.

III. Both VPA and PAM

Blk-Brn lead from radio connects to PAM-9, from PAM-21 to MD-15, from MD-5 to VPA-3, from VPA-2 to ACM-16. Brn-Blk lead (unscrambled receive audio) from VPA-16 connects to PAM-18, and then a Brn-Blk lead from PAM-7 connects to ACM-6.

3 MIC HI

Brn lead from radio connects first to STE-20. Blk-Yel lead connects from STE-10 to TCE-17, and from TCE-7 to VPA-18. Yel-Blk lead from VPA-6 connects to ACM-11.

4 AUDIO SHIELD

Shield has no priorities. Changes to Vio-Blk lead out of an accessory. Goes to mobile decoder, channel scan, public address and finally to ACM-10.

5 SQUELCH

Blk-Yel lead from radio connects to CSM-3. Red-Blu from CSM-1 connects to PAM-13, and from PAM-2 to ACM-17.

6 MIC LO (SHIELD)

Mic shield connects to TCE-18. Vio-Blk from TCE-8 connects to VPA-19, and from VPA-8 to ACM-21.

7 SPKR HI

Org speaker hi lead from radio connects to PAM-20 and Org-Grn lead from PAM-10 connects to ACM-9.

8 AUDIO MUTE

Blk-Blu lead connects to ACM-4 unless mobile decoder is used with "Private-Line" radio; in this case it terminates at MD-7.

9 PTT

Blk-Org lead from radio connects to STE, TCE, MPL, VPA, or CSM in that Priority and then to ACM-22.

10 SPARE

Blk-Gray lead from radio connects to MPL-18 or it is tied back if no MPL is used.

11 FREQ SEL GND (SCAN ONLY)

Connect Blk-Wht lead from CSM-14 to P102-1 (Blu) on Alternate Control Module. Remove JU103 on ACM board to allow Freq Sel Gnd to be controlled by scan module.

12 PTT REF/IGNITION SENSE

Connect Org PTT Ref lead from CSM-1 to STE-18, from STE-8 to VPA-22, from VPA-11 to ACM-13.

If ignition lead option is used, Org lead from F401 connects to CSM-4 or if CSM is not used STE-5 or to VPA-22 if no STE is used. JU104 in ACM must be cut if this option is used.

13 MOBILE DECODERS

Grn wire from mic or handset hangup box connects to MD-19. Org jumper from MD-22 connects to MD-4 for tone and voice operation or to MD-10 for tone only operation. For PL radios Blk-Blu lead (audio mute) from radio terminates at MD-7 (see note 8).

14 VOICE PRIVACY ADAPTER

When VPA is used, JU108 and R111 are removed from alternate control module and JU109 is added. This allows ACM-6 to be used as an unscrambled rec audio input to the volume control.

NOTE
If a handset hangup box is used in a system with VPA, its red lead is tied back and JU101 is left in so that earpiece audio is always on. Speaker audio may still be switched off when off-hook by deleting JU102.

15 PUBLIC ADDRESS OR SIREN

I. PUBLIC ADDRESS

The radio microphone is connected to the 6-pin connector (outer position) on the PAM and the cable from the other 6-pin connector (inside position) connects to microphone jack J103 on the ACM. The external speaker plugs into the 2-pin connector on the PAM.

II. SIREN

The radio microphone is connected to the 6-pin connector (inside position) on the SCM. The cable from the 6-pin connector (outside position) connects to the microphone jack J103 on the ACM.

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INTERCONNECT CHART

CONNECT WIRES FROM HERE → TO THE OPTION(S) HERE → THEN HERE

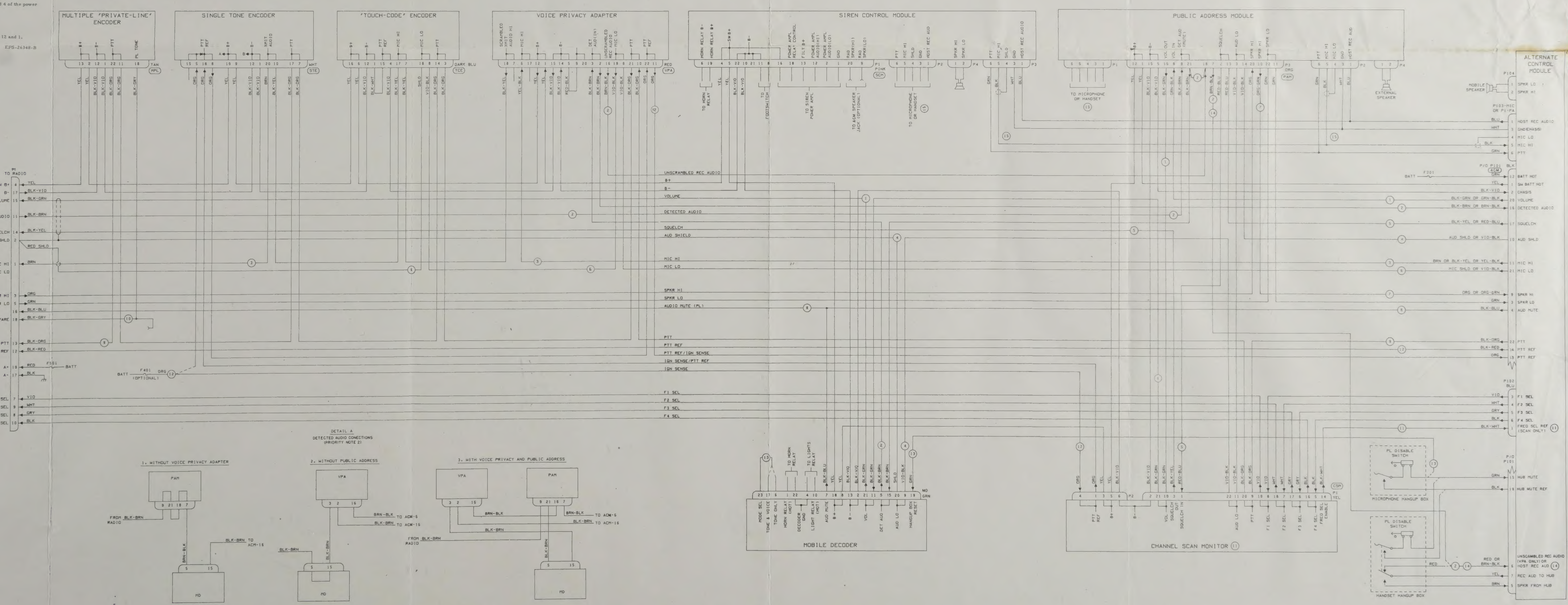
CABLE FROM RADIO SET		SEE NOTE	SOLID STATE M "PL" ENCODER		MULTIPLE "DPL" OR REED TYPE M "PL" ENCODER	SINGLE-TONE ENCODER	T-C ENCODER	VOICE PRIVACY ADAPTER	MOBILE DECODERS	"CHANNEL SCAN" MONITOR		PUBLIC ADDRESS	SIREN			ALTERNATE CONTROL MODULE		
WIRE COLOR	FUNCTION		TAN CONNECTOR		TAN CONNECTOR	WHITE CONNECTOR	DARK BLU CONNECTOR	RED CONNECTOR	GREEN CONNECTOR	6-PIN CONNECTOR	YELLOW CONNECTOR	ORANGE CONNECTOR	PINK CONNECTOR			P101	P102	P103
YEL	B+		13, 2		13,2	19, 9	16,6	12, 1	18, 8	3, 5		12, 1	4, 5			1		
BLK-VIOLET	B–		12, 1		12,1	12, 1	12, 4	15, 14	13, 2	6	2	15, 5	22, 10			2		
BLK-GRN	VOLUME	(1)							*21, 11		*21, 10	** ←19, 8 ← GRN-BLK				20		
BLK-BRN	DETECTED AUDIO	(2)						***3, 2	**15, 5			*9, 21 ← 18, 7 ← W/O VPA *9, 21 WITH VPA				16		
BRN	MIC HI	(3)				*20, 10 → BLK-YEL	17,7 → BLK-YEL	** →18 or 7, 17 or 6 → YEL-BLK								11		
SHIELD	MIC GND	(6)	20,21				→ 18, 8 → VIOLET BLK	**19, 8 → VIOLET-BLK								21		
BLK-YEL	SQUELCH	(5)									→*3, 1→	**13, 2				17		
SHIELD	AUDIO GND	(4)							→ 20, 9 → VIO-BLK		22, 11 → VIO-BLK	14, 3 → VIO-BLK				10		
ORG	SPKR AUDIO HI	(7)										→20, 10 → ORG-GRN				9		
GRN	SPKR AUDIO LO											22, 11				3		
BLK-BLU	"PL" ON/OFF	(8)							7 ("PL" ONLY)							4		
BLK-ORG	P-T-T	(9)			22,11	17,7	14, 3	21, 10			20, 9					22		
BLK-GRY	SPARE	(10)	*18		*18											TAPE BACK		
VIO	F1										19, 8						3	
WHT	F2										18, 7						4	
GRAY	F3										17, 6						5	
BLK	F4										16, 5						6	
BLK-RED	SW. BATT HOT															14		

ADDITIONAL CONNECTIONS

WIRE COLOR	FUNCTION	SEE NOTE	SOLID STATE M "PL" ENCODER		MULTIPLE "DPL" OR REED TYPE M "PL" ENCODER	SINGLE-TONE ENCODER	T-C ENCODER	VOICE PRIVACY ADAPTER	MOBILE DECODERS	"CHANNEL SCAN" MONITOR 6-PIN	"CHANNEL SCAN" MONITOR YELLOW	PUBLIC ADDRESS	SIREN			P101	P102	P103
BLK-WHT	FREQ. SELECT	(11)									14						1	
ORG	IGNITION (FUSED)	(12)				* →15, 8→		**22, 11		* → 4, 1 →						13		
GRN	BATTERY (FUSED)															12		
BLK	MIC HANG-UP BOX															19		
GRN	MIC HANG-UP BOX	(13)							19							15		
WHT	LIGHT RELAY								1									
RED	HORN RELAY								12									
BLK	RELAY GND								17 & 6									
SPEAKER																		1
SPEAKER																		2
RED-BLK																		
ORG	MODE JUMPER		9→10						22 → 4 or 10									
BRN-BLK	V.P.A. OUT	(2)(14)						16→				18, 7				6		
BLK WHT	P-T-T REF						15→ 1											

LEGEND:
(8) REFERS TO NOTE NUMBER
→ 8 REFERS TO LEAD GOING TO A PIN
8 → REFERS TO LEAD COMING FROM A PIN
* INDICATES FIRST PRIORITY ACCESSORY. LEADS MUST GO TO THIS MODULE FIRST IF MULTIPLE MODULES ARE CONNECTED
** INDICATES SECOND PRIORITY ACCESSORY
*** INDICATES THIRD PRIORITY ACCESSORY

EEPS-26345-B



PEPS-26349-B

SERVICE SHEET

MOTOROLA

MITREK® /Systems 90

MOBILE ACCESSORY GROUP

INSTALLATION INSTRUCTIONS

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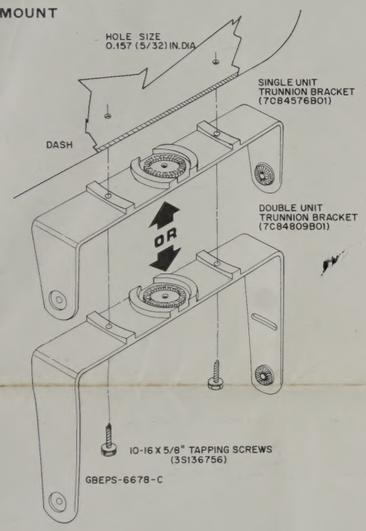
3/21/79

SERVICE PUBLICATIONS
1301 E. ALGONQUIN RD.
SCHAUMBURG, ILLINOIS 60196

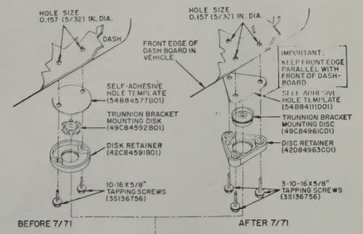
STEP 1 *TRUNNION MOUNT INSTALLATION*

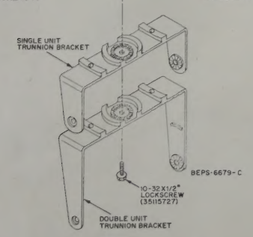
SOLID MOUNT



OR

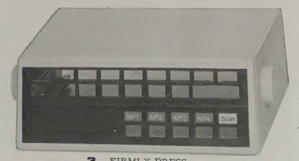
BREAKAWAY



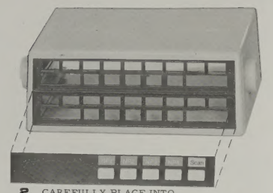


NOTE
ONLY DASH TYPE MOUNTING IS SHOWN. FOR FLOOR MOUNTING, USE THE SAME PROCEDURE AS SHOWN HERE.

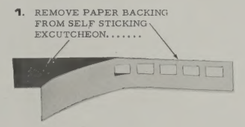
STEP 2 *ESCUTCHEON PLACEMENT*



3. FIRMLY PRESS INTO PLACE



2. CAREFULLY PLACE INTO DESIRED POSITION ON HOUSING..

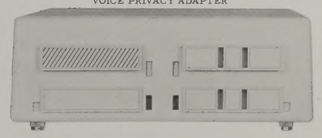


1. REMOVE PAPER BACKING FROM SELF STICKING ESCUTCHEON.....

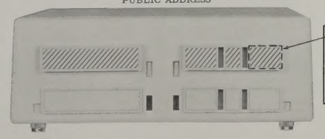
AEPS-6682-O

STEP 3 *CONNECTOR KNOCKOUT*

MOBILE "WILD CARD"
SELECTIVE SIGNALLING DECODER
SINGLE-TONE ENCODER
MULTIPLE "PL" ENCODER
VOICE PRIVACY ADAPTER

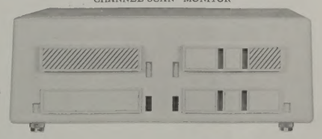


ALTERNATE CONTROL MODULE
PUBLIC ADDRESS



NOTE
DO NOT REMOVE FOR 1-FREQ. ALTERNATE CONTROL MODULE.

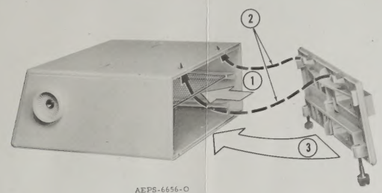
"CHANNEL SCAN" MONITOR



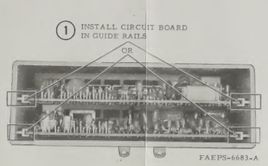
AEPS-6684-A

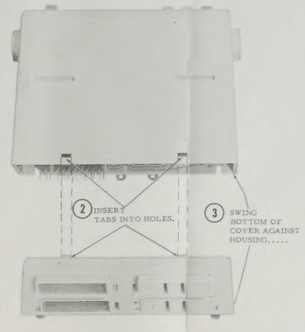
NOTE
WITH THE REAR COVER DETACHED FROM THE HOUSING, REMOVE THE KNOCK-OUT PANEL(S) FOR THE APPROPRIATE ACCESSORY CONNECTOR AS INDICATED ABOVE.

STEP 4 *CIRCUIT BOARD AND REAR COVER INSTALLATION*

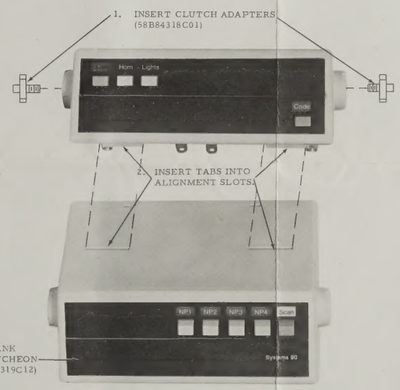


AEPS-6656-O



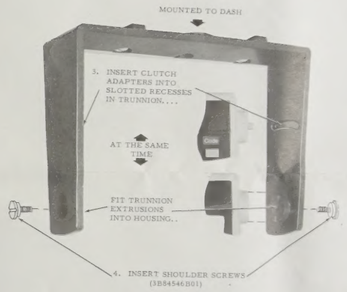


STEP 5 *HOUSING AND TRUNNION ASSEMBLY*

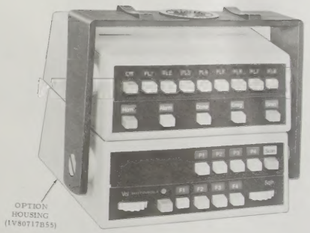


AEPS-6862-O

NOTE
ONLY DASH MOUNTED ASSEMBLY IS SHOWN HERE. FOR FLOOR MOUNTED ASSEMBLIES THE CLUTCH ADAPTERS MUST BE INSTALLED ON THE LOWER UNIT, AND THE SHOULDER SCREWS WILL BE INSERTED ON THE UPPER UNIT.

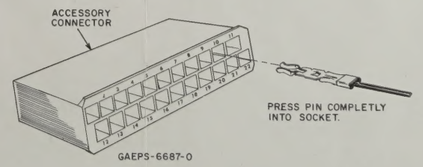


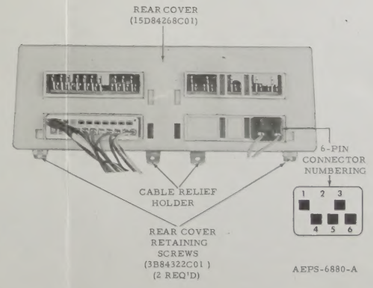
ASSEMBLED UNITS

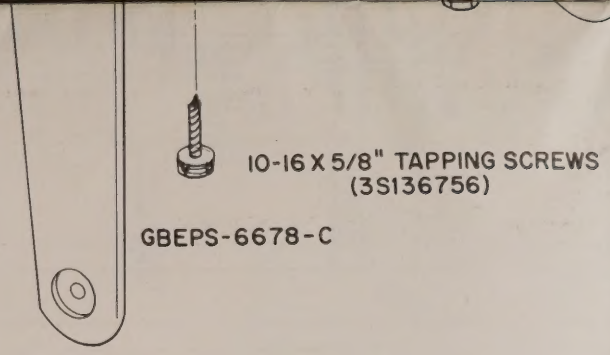


FCEPS-6685-B

STEP 6 *PIN AND CONNECTOR INSTALLATION*

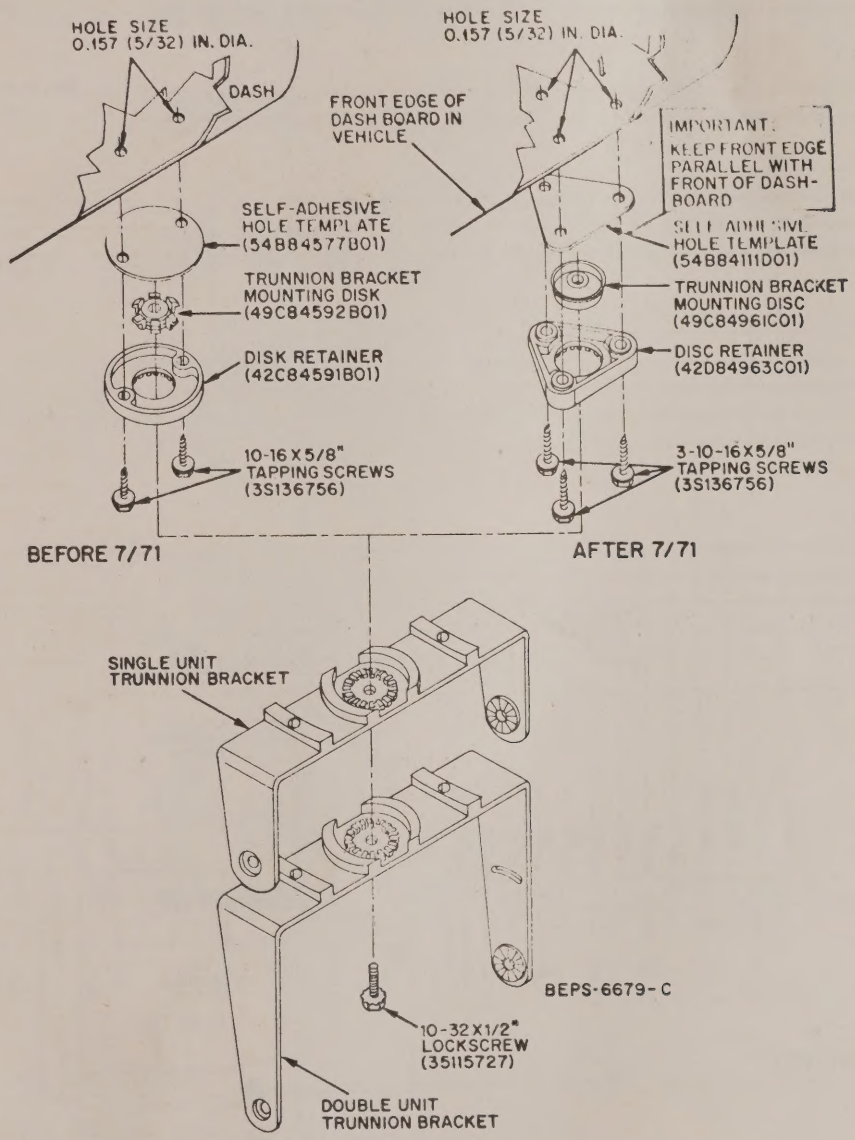






OR

BREAKAWAY



NOTE

ONLY DASH TYPE MOUNTING IS SHOWN. FOR FLOOR MOUNTING, USE THE SAME PROCEDURE AS SHOWN HERE.

MOTOROLA INC.

Communications Group

instruction manual revision

Supersedes SMR-4267

GENERAL

This revision consists of changes that have occurred since your instruction manual was printed. Please correct your manual accordingly.

INSTRUCTION MANUALS AFFECTED:

68P81106E95-C	MITREK/MICOR SYSTEMS 90 Mobile Multiple "Private-Line" Encoder
68P81106E96-B	MICOR/SYSTEMS 90 Mobile Multiple "Digital Private-Line" Encoder
68P81108E05-A	MITREK/MICOR SYSTEMS 90 Electronic Siren and Public Address System
68P81109E57-A	MITREK/SYSTEMS 90 Mobile Public Address
68P81109E58-A	MITREK/SYSTEMS 90 Channel Scan Monitor

REVISION DETAILS:

Because of a change in manufacturing location, we have changed the part numbers on certain cable assemblies. We will supply the correct part in response to orders giving either number, but the part itself will carry the new number. The new numbers are tabulated below.

Manual	Old Number	New Number
68P81106E95-C	TKN6507A	HKN4049A
68P81106E96-B	TKN6507A	HKN4049A
68P81108E05-A	TKN6505A	HKN4045A
68P81109E57-A	TKN6505A	HKN4045A
68P81109E58-A	TKN6502A	HKN4043A

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WMR-0041
6-28-82 GGI

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81109E58-A Mitrek Systems 90 Channel Scan Monitor (Models HLN1002A, HLN1003A)

REVISION DETAILS:

Refer to Circuit Board Detail, Motorola No. PEPS-27370-A.

On the circuit board detail, transistors Q12 thru Q15, Q19, and Q27 (Motorola Part No. 48-869571) are incorrectly shown as NPN types. These transistors are PNP types as indicated in parts list PL-6124-0. Make these corrections to the circuit board detail in your instruction manual. These transistors are correctly shown on the schematic diagram.

MITREK SYSTEMS 90

CHANNEL SCAN MONITOR

Technical Characteristics

MODEL		HLN1003A	HLN1002A
OPERATION		Sequential sampling with selectable priority	Sequential sampling with selectable non-priority
INPUT VOLTAGE		13.8 V dc ± 20%	
CURRENT DRAIN AT 13.8 V DC	SCAN "OFF"	180 mA	
	SCAN "ON" NO SIGNAL RECEIVED	340 mA	
	SCAN "ON" SIGNAL RECEIVED	360 mA	
OPERATING TEMPERATURE RANGE		-30°C to +60°C	
APPLICATION		All multi-frequency MITREK FM two-way radios	
NON-PRIORITY CHANNEL SCANNED		Every 48 milliseconds for 6 milliseconds during no signal input conditions.	
PRIORITY CHANNEL SAMPLED		Every 12 milliseconds for 6 milliseconds during no signal input conditions. Every 250 milliseconds for 6 milliseconds while non-priority signal is received.	

1. DESCRIPTION

The priority and non-priority model "Channel-Scan" monitors allow the operator of a multi-frequency MITREK FM mobile radio to monitor up to four channels with its single receiver. When a signal is received on any channel, the unit stops scanning and the message is heard. However, if it stops on a non-priority channel, the unit continues to sample the priority channel at a rate which does not disturb the intelligibility. When a signal is received on the priority channel, the receiver switches to the priority channel and all scanning stops until priority is inactive. This assures that the operator can monitor any of the channels which the radio is capable of receiving without missing any messages on the priority channel.

The two models are physically similar. Jumper connections and the channel select switch assemblies are different to provide priority or non-priority selection capability.

1.1 NON-PRIORITY MODEL

This model allows the operator to monitor one, two, or three channels on a non-priority, first come, first served basis.

NOTE

All four switches may be depressed at the same time. But, as shipped from the factory, priority status is automatically given to the channel selected by the control head channel selector switch. Priority may be fixed to a particular channel with a simple jumper change.

1.2 PRIORITY MODEL

This model allows the operator to select the desired priority channel. Only one channel has priority — remaining channels have non-priority status (switches are interlocked).

MOTOROLA INC.
Communications Division

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68P81109E58-A
3/27/79-NPC

2. INSTALLATION

2.1 FIELD INSTALLED

The "Channel-Scan" monitor circuit card is installed in the "Systems 90" accessory housing, either alone or in combination with other "Systems 90" options. The installation instructions provided here are for the "Channel-Scan" monitor used as the only option.

NOTE

For instructions pertaining to multiple option installations, refer to the Installation Instructions supplied with the housing assembly.

To add "Channel-Scan" monitor capability to a negative ground system, refer to Figures 1 and 2 and proceed as follows:

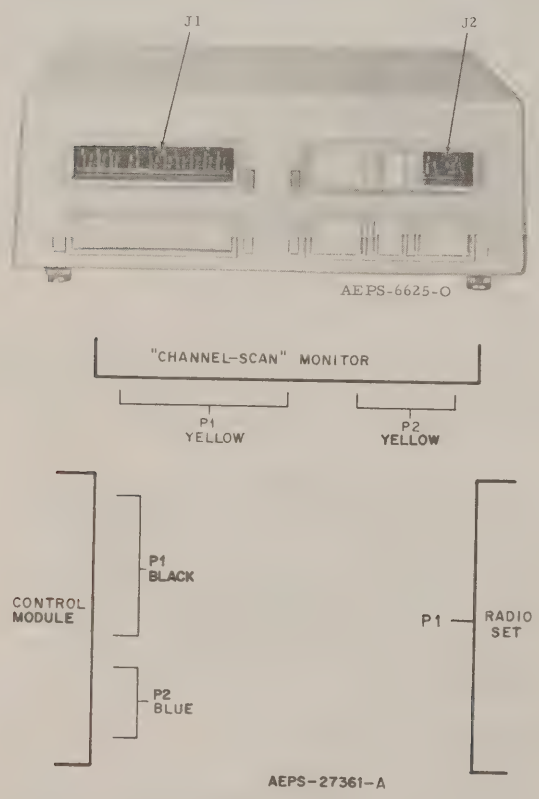


Figure 1. "Channel-Scan" Monitor Plug and Jack Location Detail

Step 1. Check jumper on circuit card connections as shown in Table 1.

Table 1. Jumper Connections (As Shipped From Factory)

MODEL	JU1-JU8	JU10 & JU11	JU9
Priority Model	All Connected	JU10 out JU11 to "PS" Pad	To "S" Pad
Non-Priority Model	All Removed	JU11 out JU10 to "S" Pad	

Step 2. Peel the paper backing from the escutcheon and press into place on the front of the "Systems 90" accessory housing.

Step 3. When the "Channel-Scan" monitor unit is used with 2- or 3-frequency radios, the unused pushbutton switches must be "pinned" as shown in Figure 2.

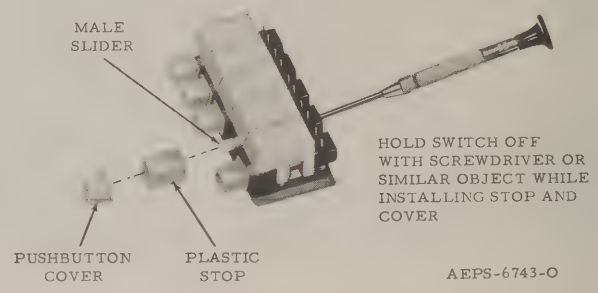


Figure 2.

NOTE

With priority select Model HLN1003A, to prevent false lamp indication, the corresponding jumper JU1-JU4 must be cut for unused channel (see schematic diagram). To expand later, this jumper must be replaced in addition to removing the stop.

a. Pull the applicable pushbutton plastic cover straight off. A screwdriver may be carefully used to give added leverage.

b. Install the supplied plastic pushbutton stop.

c. Push cover back onto pushbutton switch.

Table 2. Optional Jumper Connections

MODEL	JU1-JU8	JU10 or JU11	JU9
Priority Model	All Connected	JU11 to "PS" Pad JU10 out	To "S" Pad if control head frequency selector switch determines transmitter frequency.
Non-Priority Model	All Removed	JU11 out JU10 to "S" Pad for control head frequency selector switch to establish priority To Pad "1" for fixed channel 1 priority To Pad "2" for fixed channel 2 priority To Pad "3" for fixed channel 3 priority To Pad "4" for fixed channel 4 priority	To Pad "1" for fixed channel 1 transmit To Pad "2" for fixed channel 2 transmit To Pad "3" for fixed channel 3 transmit To Pad "4" for fixed channel 4 transmit

CAUTION

Be sure not to close the switch when replacing the cover. Hold the little male slider pin that protrudes from the rear of the switch and push the cover on. This pin is "in" when the switch is "open".

Step 4. Slide the circuit card completely into the housing assembly.

Step 5. Install the rear housing cover and secure with two captive screws.

Step 6. Disconnect the black connector (P1) from the control module.

Step 7. Use the contact removal tool to remove the following wires, with pins attached, from P1 (black).

a. Yellow wire from position 1.

b. Black-violet wire from position 2.

c. Black-yellow wire from position 17.

d. Audio shield from position 10.

e. Black-green wire from position 20.

f. Black-orange wire from position 22.

g. Orange wire from position 13. (Note: this wire is an option and not present in all systems.)

Step 8. Insert the pins and wires which were removed from control module P1 into the yellow channel scan connector (P1) as follows:

a. Black-yellow wire into position 3.

b. Black-green wire into position 21.

c. Shield wire into position 22 (w/clear sleeving).

d. Black-orange wire into position 20.

Step 9. Insert the pins and wires which were removed from control module P1 into the yellow 5-pin channel scan connector (P2) as follows:

a. Yellow wire into position 3.

b. Black-violet wire into position 6.

c. Orange wire into position 4.

Step 10. Insert the pins and wires connected from "Channel-Scan" P1 into control module P1 as follows:

a. Black-violet wire into position 2.

b. Red-blue wire into position 17.

c. Black-green wire into position 20.

d. Violet-black wire into position 10.

e. Black-orange wire into position 22.

Step 11. Insert the pins and wires connected from "Channel-Scan" P2 into control module P1 as follows:

a. Yellow wire into position 1.

b. Orange wire from P2-1 into position 13.

c. Orange wire from P2-4 to ignition switch (with fuse). Note that this wire is an option and is not present on all systems.

Step 12. Using the contact removal tool, remove the violet, white, gray, and black wires from control module P2 (blue).

Step 13. Insert the pins which were removed from P2 (blue) into P1 (yellow) as follows:

a. Connect the violet wire to pin 19.

b. Connect the white wire to pin 18.

c. Connect the gray wire to pin 17.

d. Connect the black wire to pin 16.

Step 14. Connect the leads from P1 (yellow) of the "Channel-Scan" monitor to P2 (blue) of the control module as follows:

a. Connect the black-white lead from pin 14 of P1 to pin 1 of control module P2 (blue).

b. Connect the violet lead from pin 8 of P1 to pin 3 of control module P2 (blue).

c. Connect the white lead from pin 7 of P1 to pin 4 of control module P2 (blue).

d. Connect the gray lead from pin 6 of P1 to pin 5 of control module P2 (blue).

e. Connect the black lead from pin 5 of P1 to pin 6 of control module P2 (blue).

Step 15. Reconnect P1 (black) and P2 (blue) to the control head and connect P1 (yellow) and P2 (yellow) to receptacles J1 and J2, respectively, on the rear of the "Channel-Scan" monitor circuit board.

2.2 POSITIVE GROUND INSTALLATION

Except for the following steps, the installation of a "Channel-Scan" monitor in a positive ground system is the same as that described in the negative ground installation procedure.

Step 7. A yellow wire is not connected to control module pin 1. A blue wire is connected and should not be removed. The yellow wire (which is tied back) should be untied at this time.

Step 11. Discard the yellow lead connected from pin 5 of "Channel-Scan" (P2 yellow) to pin 1 of control module (P1).

NOTE

When placement of all wires has been completed —

a. Move the orange wire (2 wires with ignition switch power option) on pins 1 and 4 of P2 (yellow) to pins 20 and 9 of P1 (yellow).

b. Move the black-orange wires on pins 20 and 9 of P1 (yellow) to pins 1 and 4 of P2 (yellow).

c. Move the yellow wire on pin 3 of P2 (yellow) to pin 6 of P2 (yellow).

d. Move the black-violet wires on pin 2 of P1 (yellow) and pin 6 of P2 (yellow) to pins 3 and 5 of P2 (yellow).

2.3 REQUIRED CONTROL MODULE FIELD MODIFICATIONS

The MITREK control module must be modified to work with the "Channel-Scan" monitor unit as follows:

Step 1. Remove the back cover of the control module housing by loosening the two captive screws on the bottom and lifting the back off.

Step 2. Remove JU103.

Step 3. Reinstall the back cover.

2.4 FACTORY WIRED

When the "Channel-Scan" monitor is purchased as part of a radio system, the wiring changes will have been completed. The individual system components are shipped with all interconnecting cables attached, to permit a thorough system checkout before unpacking.

Step 1. Install the radio and cabling as directed in the radio installation instructions.

Step 2. Connect the black (P1) and blue (P2) connectors to the control head.

Step 3.Connect the yellow (P1) and yellow (P2) to the "Channel-Scan" monitor unit at J1 and J2, respectively.

3. OPERATING PROCEDURE

3.1 GENERAL

The operator controls on the "Channel-Scan" monitor consists of five pushbutton switches as shown in Figures 3 and 4. The SCAN on-off switch turns the unit on. The "NP" channel select switches (non-priority model only) select the desired non-priority channels (any number may be pushed in at the same time). The "P" channel select switches (priority model only) select the desired priority channel (only one at a time). Any "NP" or "P" channel select switches not used in a particular system are "pinned" and cannot be pushed.

Other controls used while operating the "Channel-Scan" unit are the SQUELCH and VOLUME controls on the control module.

3.2 CONTROL MODULE ADJUSTMENTS

Step 1. With the SCAN on-off switch on the monitor unit to the off position (out), turn the SQUELCH control fully counterclockwise.

Step 2. Turn the VOLUME control clockwise until noise is heard from the speaker.

Step 3. While no signal is being received, slowly turn the SQUELCH control clockwise until the noise just squelches (cuts out). This is the threshold squelch condition and gives the most sensitive performance of the "Channel-Scan" monitor and radio units.

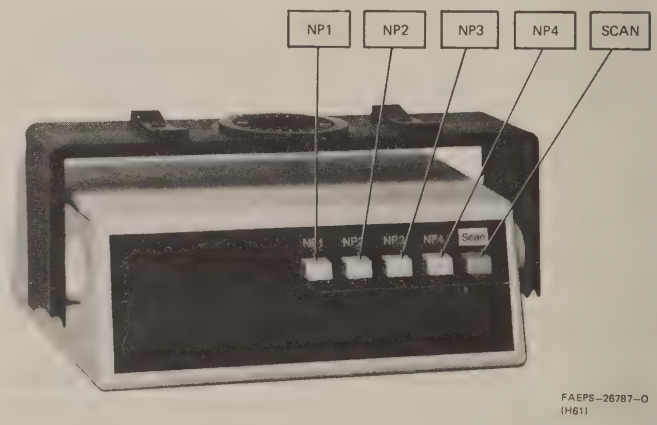


Figure 3.
Non-Priority Model Operator Controls

Step 4. With a signal being received, adjust the VOLUME control for a comfortable listening level.

3.3 NON-PRIORITY MODEL OPERATION

Step 1. Press the applicable "NP" channel selector switch for each channel desired to be monitored.

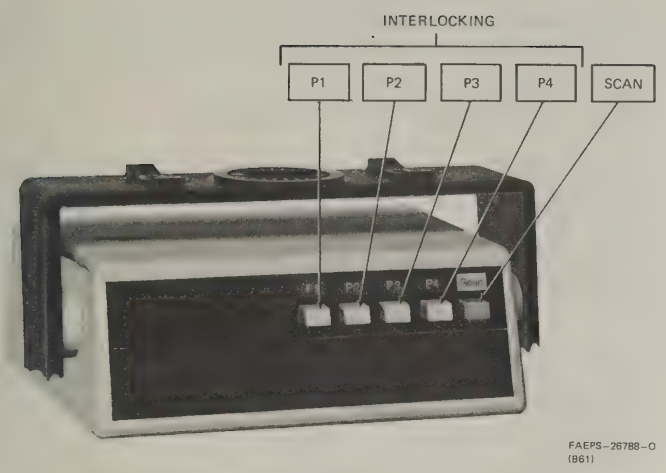


Figure 4.
Priority Model Operator Controls

Step 2. Press the SCAN on-off switch. All "NP" channel indicator lamps will illuminate and the first signal received on one of the non-priority channels selected will be heard from the speaker. The indicator lamp for this channel will become brighter and pulse to indicate continued sampling.

If the channel indicator lamps flicker sporadically without locking on a channel, advance the SQUELCH control slowly until flickering just ceases to insure continuous scanning.

NOTE

As shipped from the factory, the non-priority model has a priority channel which follows the control module frequency selector switch. A signal received on this priority channel will be heard from the speaker regardless of its selector switch position. The indicator lamp for the priority channel will become brighter and will not pulse.

Step 3. To stop scanning, press the SCAN on-off switch again to return it to its off (out) position. Scanning action will cease and the channel indicator lamps will turn off. Complete operational control reverts back to the control module (if the transmit channel element driver output is connected to the "S" pad). Readjust the SQUELCH control for desired sensitivity.

3.4 PRIORITY MODEL OPERATION

Step 1. Press the applicable "P" channel selector switch for which priority monitoring is desired. All remaining channels are automatically given non-priority status.

Step 2. Press the SCAN on-off switch. All "P" channel indicator lamps will illuminate and the first signal received will be heard from the speaker. If this is a non-priority channel, the indicator lamp for the monitored channel becomes brighter and pulses to indicate continued sampling. A signal on the priority channel is automatically heard from the speaker whether messages are present on other channels or not, and the priority channel indicator lamp becomes brighter and does not pulse.

NOTE

Field modifications may have been made to the unit to "fix" priority to one channel, regardless of the channel select switches status.

Step 3. To stop scanning, press the SCAN on-off switch again to return it to its off (out) position. Scanning action will cease and the channel indicator lamps will turn off. With the monitor off or when transmitting, complete operational control reverts back to the control module (if the transmit channel element driver output is connected to the "S" pad). Readjust the SQUELCH control for desired sensitivity.

4. THEORY OF OPERATION

4.1 GENERAL

Both the non-priority and priority model "Channel-Scan" units monitor non-priority and priority channels. Specific channel non-priority or priority status is determined by internal scan unit jumper connections and the channel select pushbutton switches, or the control module frequency selector switch. As shipped from the factory, non-priority is selectable with the non-priority model while priority is selectable with the priority model.

Once priority status is determined, the channels are scanned in sequence until a carrier is received. The unit will then stop scanning and lock onto that channel if it is a priority channel. If it is a non-priority channel, it will lock onto that channel but will continue to sample the priority channel four times a second to ensure the complete reception of all priority channel messages. If a non-priority signal was being received when a priority signal arrived, the unit will revert to that same non-priority channel when the priority signal disappears. Normal sequential scanning resumes when no signals are present.

When a channel is "scanned" or "sampled", a ground is applied to its particular receiver channel element from the scan unit. This enables the channel element which, in effect, turns that receiver channel on. If there is no signal on that channel, the scan unit then ungrounds the channel element, inhibiting that channel, and sequentially, enables the next channel searching for an on-channel signal.

The following discussion describes circuit operation during no signal input conditions and received

signal input conditions. Refer to the schematic diagram at the end of this manual while the reading the following discussion.

4.2 NO ON-CHANNEL SIGNAL CONDITION

4.2.1 Squelch IC1

The "Channel-Scan" monitor unit receives its input from the arm of the SQUELCH control in the associated control module. This allows the noise input level to be adjusted to the desired threshold level.

While there is no on-channel signal, the input noise level to squelch IC1-15 is high which causes its output at pin 10 to be a logic "high" (5 V dc). Figure 5 shows the relationship of input noise at J1-1 (upper trace) to IC1-10 output (lower trace).

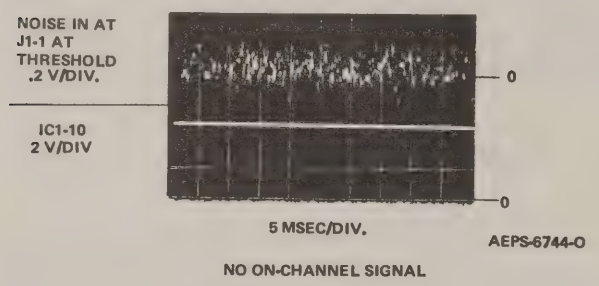


Figure 5.

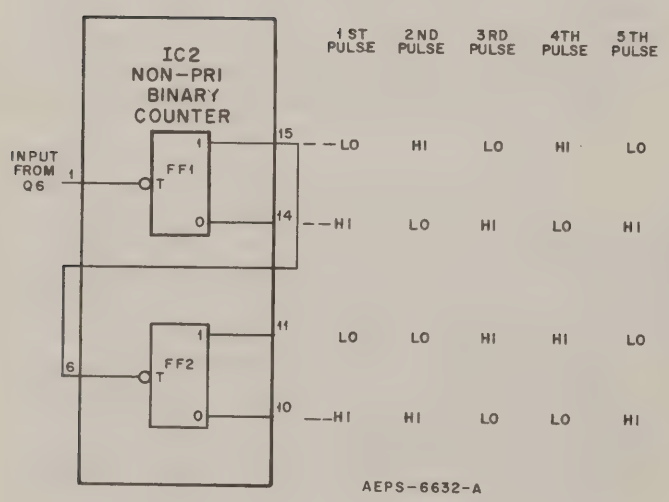


Figure 6.

4.2.2 1st Current Amplifier, Gate, Gate Driver, Gate, and High-Speed Clock Multivibrator

While IC1-10 is "high" first current amplifier Q1 is conducting, gate Q3 is cut off, gate driver Q4 and gate Q5 are conducting. This provides an emitter ground to Q6 through Q5 which enables the high-speed clock multivibrator Q6 and Q7. This multivibrator runs with a period of approximately 20-22 milliseconds (a pulse lasts approximately 10-11 milliseconds). These pulses are routed to non-priority binary counter IC2.

4.2.3 Non-Priority Binary Counter IC2

Refer to Figure 6. Integrated circuit IC2 is a dual flip-flop binary counter with one input and four outputs. As connected, four unique output states occur, in sequence, as pulses are applied to pin 1 from the high-speed clock multivibrator.

IC2 input relationships are shown in Figures 7 and 8. The top waveform of Figure 7 shows input pulses arriving at pin 1. The bottom waveform shows resulting output pulses at pin 15. The top waveform of Figure 8 shows input pulses to pin 6 while the bottom waveform shows output pulses at pin 11.

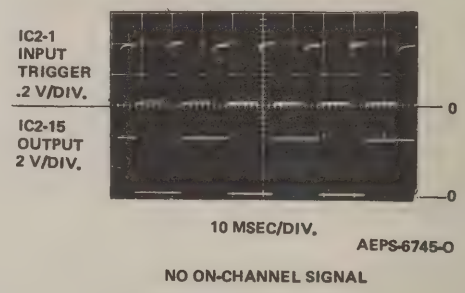


Figure 7.

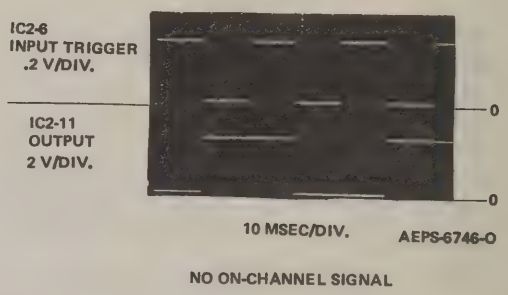


Figure 8.

4.2.4 Non-Priority Decoder IC3

The output of non-priority binary counter IC2 is connected to non-priority decoder IC3. This IC consists basically of four AND gates which convert IC2 output combinations into channel 1, 2, 3, or 4 intelligence. Refer to Figure 9.

Each AND gate requires a logic "high" on both input leads to produce a logic "high" (approximately 5 volts) output. As connected to non-priority binary counter IC2, only one AND gate can receive both logic "highs" at any one time. Therefore, one AND gate has a logic "high" output while the remaining three AND gates have logic "low" (approximately 0 volts) outputs. The logic output states shown in Figure 9 illustrate a

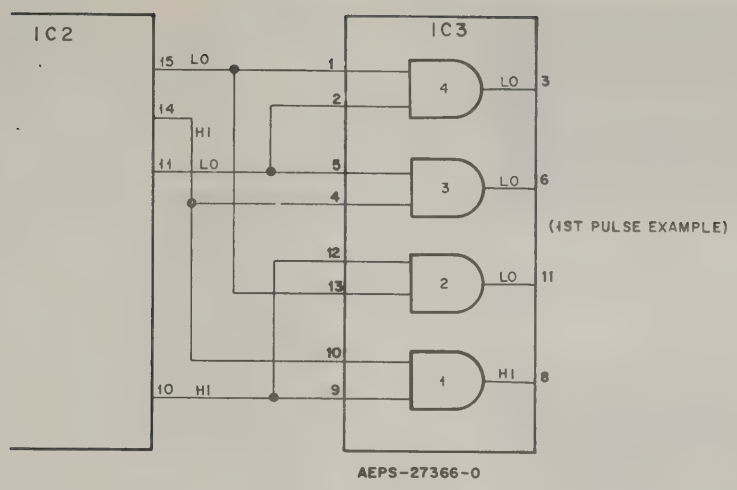


Figure 9.

first received pulse condition. As shown in Figure 6, a second pulse causes IC2-15 and -10 only to go high. IC3 AND gate 2 is connected to IC2-15 and -10 and therefore is the only AND gate with a "high" output due to the reception of the second pulse.

4.2.5 Lamp and Non-Priority Channel Element Driver IC4

The output of non-priority decoder IC3 is applied to the lamp and non-priority channel element driver IC4. This IC consists basically of four dual input NAND gates — two input "highs" are required to produce a "low" output. Each NAND gate is connected to one output from decoder IC3 *and* to non-priority inhibit switch Q22. Refer to Figure 10.

While there is no on-channel message, a logic "high" appears on IC4-1, -4, -10, and -12 from non-priority inhibit switch Q22. When a logic "high" arrives from decoder IC3, the associated IC4 NAND gate provides a logic "low" output.

A logic "low" from one of the four IC4 output terminals: (1) activates the associated receiver channel element by grounding it, and (2) allows the associated channel indicator lamp to become brighter.

For example, a logic "low" at IC4-6 is routed through non-priority select switch NP1 if closed (non-priority model) or via jumper JU1 (priority model) to the F1 receiver channel element in the radio set. The "low" is also routed through diode CR3 to lamp driver inhibit switch Q8 which grounds the emitter. Q8 will remain off, however, until bias drive is supplied from the collector of 1st current amplifier Q1 which occurs during on-channel message conditions. When Q8 conducts, bias drive is supplied to lamp driver Q12 which, in turn, provides a low resistance current path around resistor R36 to lamp DS1. The lamp then becomes brighter, IC4 pins 3, 8, and 11 are used with F2, F3 and F4 receiver channel elements, and Q9, Q10, and Q11 lamp driver inhibit switches respectively.

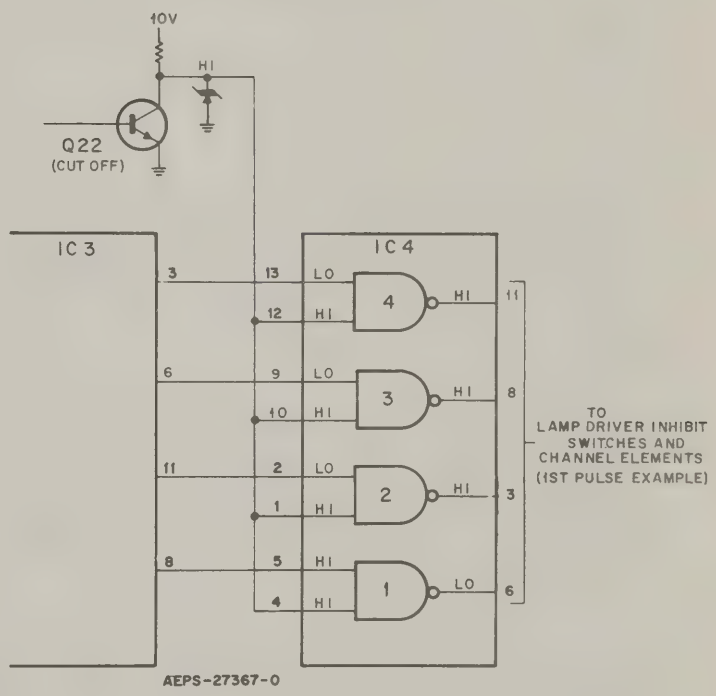


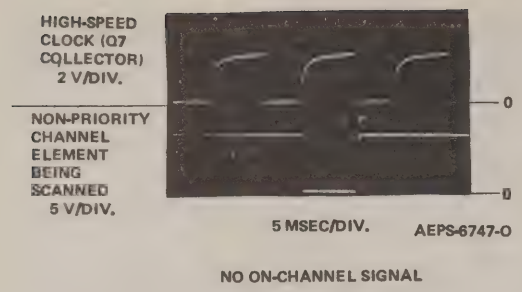
Figure 10.

The top waveform in Figure 11 shows the output pulses that occur on the collector of Q7 while no signal is being received. The bottom waveform shows a non-priority channel element being "activated" during no signal input conditions and can be found at any IC4 output pin.

4.3 ON-CHANNEL SIGNAL CONDITION

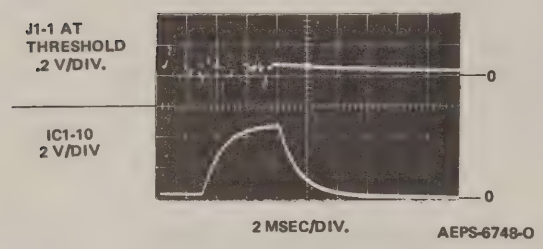
4.3.1 Squelch IC1

When an on-channel message is received, receiver noise output is reduced. When the received signal strength is above the reference level established by setting of the control module SQUELCH control, the output from IC1-10 is at a logic "low". The upper trace



NO ON-CHANNEL SIGNAL

Figure 11.



PRIORITY SAMPLED DURING RECEIVED NON-PRIORITY SIGNAL

Figure 12.

of Figure 12 was taken at J1-1. It illustrates receiver quieting due to the reception of an on-channel signal. The lower trace shows IC1 output at pin 10 dropping to a logic "low" (0 volts), when the signal is received.

4.3.2 Squelch Timing Circuit

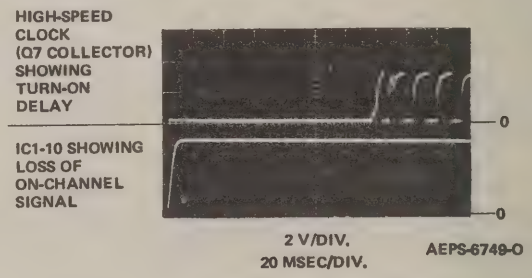
Pin 12 of IC1 is connected to a circuit within the squelch integrated circuit which has the ability to distinguish between weak and strong signals. When a weak signal is detected (a signal less than 20 dB quieting) the voltage on pin 12 rises to about 5.0 volts, charging C35. This charge on C35 causes a long squelch drop-out or "squelch tail" to prevent loss of signal on fades.

This long squelch response on weak signals cannot, however, be tolerated when sampling priority in the presence of a weak non-priority signal. The long response time would cause an unacceptably large "hole" to be cut in the non-priority message. It is for this reason that transistor Q36 and its associated circuitry is provided to rapidly discharge C35 when sampling priority.

When the priority sampling monostable begins its cycle, the collector of Q27 goes positive. A positive pulse is coupled from this collector through isolation diode CR23, capacitor C34, and resistor R90 to the base of Q36. Q36 turns on,shorting capacitor C35 to ground, rapidly discharging it. The time constant of C34-R90 is set so that the grounding is applied for approximately 3 milliseconds. This allows time for the squelch to respond to the new channel being looked at, but is short enough to allow activation of the long squelch tail feature if a weak signal is detected on priority. Resistor R89 allows capacitor C34 to discharge between samples.

4.3.3 1st Current Amplifier, Gate, Gate Driver, Gate, and High-Speed Clock Multivibrator

While IC1-10 is "low", first current amplifier Q1 is cut off, gate Q3 is conducting, gate driver Q4 and gate Q5 are cut off. This disables the high-speed clock multivibrator Q6 and Q7 by removing the emitter ground to Q6. While the high-speed clock multivibrator is inhibited, binary counter IC2 stays in the state created by the last input pulse and further non-priority channel scanning is prohibited. With the non-priority channel model, the message will be heard if the associated channel select pushbutton switch is closed. With the priority model, the message will be heard unless there is a message on another channel which has priority. A delay network is used to prevent the resumption of non-priority channel scanning should a received signal be lost or "fade" for less than approximately 150 milliseconds. When a received signal is lost, gate Q3 stops conducting immediately and capacitor C14 begins to charge. After approximately 150 milliseconds, C14 is charged sufficiently to forward bias Q4 and Q5, the high-speed clock multivibrator is enabled, and scanning resumes. This is illustrated in Figure 13. The bottom waveform shows the output at IC1-10 going from a logic "low" (low noise — on-channel signal received) to a logic "high" (loss of signal). The top waveform taken at Q7 collector shows by comparison that scanning resumes approximately 150 milliseconds after the loss of the signal.



ON-CHANNEL SIGNAL LOST

Figure 13.

4.3.4 Slow-Speed Clock Inhibit Switch

This switch (Q16) inhibits the output of the slow-speed clock multivibrator (Q23 and Q24) at the base of inverter Q25 while no on-channel message is being received. The base of Q16 is connected to the collector of gate Q3. While no on-channel message is being received, Q3 is cut off and Q16 is conducting, grounding the output of Q24. When an on-channel signal *is* received, Q16 cuts off and slow-speed clock pulses are passed to inverter Q25.

4.3.5 Slow-Speed Clock Multivibrator and Inverter

The slow-speed clock multivibrator (Q23 and Q24) generates pulses at the rate of 4 per second. These pulses are used to cause priority channel sampling while a message is being received on a non-priority channel.

Output pulses, if not grounded by the slow-speed clock inhibit switch Q16, are inverted by Q25 and passed to the priority sampling monostable Q26 and Q27.

4.3.6 Priority Sampling Monostable

The priority sampling monostable converts the positive pulses from Q25 into 6-7 millisecond duration positive pulses.

The monostable consists of transistors Q26 and Q27 with associated circuitry. Q26 conducts for the duration of a positive pulse from Q25. Capacitor C24 and resistor R68 form a voltage decay delay network that causes Q27 to conduct for approximately 6-7 milliseconds after Q26 is cut off. When Q27 conducts, its collector voltage is "high". Since a triggering pulse arrives at the input to the monostable at the rate of 4 times a second, a "high" is present on the collector of Q27 for 6-7 milliseconds every 250 milliseconds (during non-priority message reception conditions). This "high" output is routed to four places — (1) non-priority inhibit switch Q22, (2) priority sampling mute switch Q30, (3) priority channel element drivers Q28 and Q29 and (4) priority detect gate Q21.

4.3.7 Non-Priority Inhibit Switch

Non-priority inhibit switch Q22 disables the non-priority channel while the priority channel is being sampled, or when a priority signal is being received. This prevents the possibility of two channel elements being on at the same time which would cause spurious oscillations.

When the priority channel is sampled, Q27 conducts and applies a "high" to the base of Q22 through resistor R58. This causes Q22 to conduct which grounds one input terminal of each NAND gate in IC4. Since an output "low" is required from a NAND gate to enable its associated non-priority channel and two input "highs" to the NAND gate are required to get a "low", grounding one input terminal inhibits non-priority channel element grounding.

4.3.8 Priority Sampling Mute Switch

Priority sampling mute switch Q30 prevents a "blip" of noise from being heard each time the priority channel is sampled.

Q27 drives Q30 through diodes CR16 and CR17 and resistor R73. When the collector of Q27 goes "high", Q30 conducts and mutes receiver audio. Capacitor C25 "softens" the muting to minimize objectionable "popping" during priority sampling. C25 provides approximately 7 milliseconds of delay to Q30 turn off.

4.3.9 Priority Channel Element Drivers

Priority channel element drivers Q28 and Q29 provide a switched ground to enable the priority channel element. This occurs when the priority channel is "scanned" (a "high" on the collector of Q27) or when a message is received on the priority channel (a "high" on the collector of priority detect gate Q21).

4.3.10 Priority Detect Gate

Priority detect gate Q21 is a NAND gate "looking" at squelch IC1 output and scanning status. When on-channel signal reception (IC1-10 "low") and priority sampling happen simultaneously, this circuit causes all scanning to stop and the receiver is locked onto the priority signal.

On-channel signals cause squelch IC1-10 to go "low". First current amplifier Q1 is cut off and second current amplifier Q2 is conducting. This applies a "low" through diode CR11 to the base of priority detect gate Q21. The second input to Q21 is via non-priority inhibit switch Q22 which has a "low" output while the priority channel is being sampled. The third input to Q21 is from off-transmit revert switch Q19 which is cut off unless the "Channel-Scan" monitor unit is off or the radio set is keyed. When Q2, Q22, and Q19 outputs are "low", Q21 is cut off and a "high" is routed through resistor R55 to priority channel element drivers Q28 and Q29 which turns them on. The priority sampling monostable turns the priority channel element drivers on to sample the priority channel. The priority detect gate *holds* the priority channel element drivers on once a priority signal is detected, until that signal disappears. During an on-channel non-priority condition, capacitor C32 delays the "high" output of Q2 by about 3 milliseconds. This will have no effect on the priority detect gate turn-on time.

A "high" output from Q21 also biases on slow-speed clock inhibit switch Q16 to inhibit further slow-speed pulses at the base of Q25; and turns on non-priority inhibit switch Q22 via resistor R57 to inhibit non-priority channel element grounding.

4.3.11 Priority Clock Inverter

While there are no on-channel signals, the high-speed clock multivibrator is running and non-priority channels are sampled. Priority clock inverter Q17 causes the priority channel to be sampled after a non-priority channel has been sampled. For example, the sampling sequence of a four-frequency radio with F3 priority is F1, F3, F2, F3, F3, F3, F4, F3, F1, F3, etc.

The high-speed clock multivibrator drives binary counter IC2 via the priority sampling monostable Q26

and Q27 through priority clock inverter Q17. When the collector of Q7 goes "low", Q17 is cut off. This causes capacitor C23 to charge positively through bias resistor R67 and forward biases Q26. When the collector of Q7 goes "high", Q17 conducts and Q26 is cut off. Non-priority inhibit switch Q22 is activated by Q27 when priority is sampled during the high *or* slow speed modes. This inhibits the non-priority channel to prevent the possibility of two channel elements being on at the same time.

4.3.12 Noise Oscillator and Delay Gate

The noise oscilaltor (Q32 and Q33) keeps the receiver fully squelched to prevent a "buzzing" sound from being heard from the speaker while there is no on-channel signal. This is accomplished by generating artificial noise during the high speed scan rate, because the noise level is not sufficient to keep the receiver fully squelched. Whether the SCAN is on or off, the squelch input is routed to the "Channel-Scan" monitor circuits and the noise oscillator provides the squelch output to the radio. The delay gate (Q31) prevents the noise oscillator from squelching the radio set when the priority channel is sampled while a non-priority channel message is being received. Otherwise, a partial loss of non-priority message would result.

When an on-channel signal disappears, second current amplifier Q2 is cut off, charging C32, and its collector goes "high" after 3 milliseconds. After approximately 30 to 35 milliseconds, capacitor C27 is charged sufficiently to forward bias delay gate Q31 which provides emitter grounds to Q32 and Q33 and the oscillator is enabled.

Figure 14 shows the noise oscillator output waveform present at J1-3 when no on-channel signal is being received. A low from squelch inhibit switch Q18 enables the oscillator during transmit to prevent a noise burst from being heard in the speaker upon de-keying.

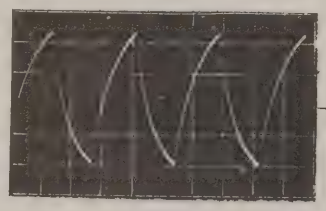


Figure 14.

Figure 15 illustrates noise oscillator turn-on delay. The bottom waveform shows squelch IC1-10 going from a logic "low" to a logic "high" when an on-channel signal is lost. Approximately 35 milliseconds later, the noise oscillator starts to oscillate as is shown in the top waveform, taken at J1-3.

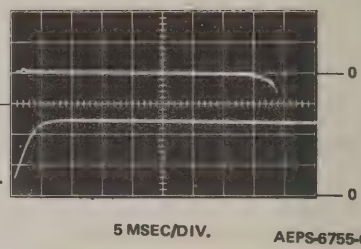


Figure 15.

4.3.13 Off-Transmit Revert Switch

This switch inhibits non-priority and priority element grounding, disables squelch during transmit, and causes transmitter channel element to be grounded when a PTT function is applied. When the SCAN switch is off, this switch performs these functions continuously.

When a ground is applied via the microphone PTT switch, Q37 conducts which causes Q19 to conduct. This causes squelch inhibit switch Q18 to conduct and grounds the output of squelch IC1. This keeps the high-speed clock from running, and insures that the appropriate lamp will light by applying bias through resistors R24-R27.

Transmitter channel element driver Q20 turns on, which routes a ground through jumper JU9 to the selected transmitter channel element. However, the transmitter channel element is not enabled until A+ is applied to it as well as the ground which is routed from the "Channel-Scan" monitor unit. When the scan is turned off, Q18 is inhibited by the low through CR10 to allow the squelch to continue to operate. The high speed clock is inhibited through CR19.

Non-priority elements are inhibited when Q19 goes "high" through diode CR12 and resistor R56. The priority element is inhibited through diode VR2 and resistor R49.

When transmitting or when "off", slow-speed pulses must be inhibited to prevent priority channel element grounding. This is accomplished when Q19 goes "high" through resistor R43 to slow-speed inhibit switch Q16.

5. MAINTENANCE

"Channel-Scan" maintenance can be broken down into two categories: in-system testing and bench testing. In-circuit testing is limited to comparing voltage measurements to those indicated on the schematic diagram but allows identification of some malfunctions while still in the vehicle. Bench testing requires complete

testing facilities but identifies those malfunctions not identifiable in the field.

Before repair is started on this circuit card, jumper status should be noted so that they can be returned to that state once servicing is completed.

5.1 IN-SYSTEM TESTING

Making circuit voltage checks necessitates removing the circuit card from the housing assembly and is accomplished as follows:

Step 1. Disconnect the two connectors attached to the circuit card.

Step 2. Loosen the two captive screws securing the rear housing cover and remove the cover.

Step 3. Slide the circuit card out of the housing assembly and place the card atop the housing with the solder side up.

Step 4. Reconnect the two connectors (removed previously) to the proper location on the circuit card.

CAUTION

Do not allow the circuit card to come into contact with any metallic object which may cause damage from an accidental short circuit.

Step 5. Apply power to the system and proceed to take the necessary voltage measurements.

5.2 BENCH TESTING

A much more thorough check of the "Channel-Scan" circuit card can be performed on a test bench which has the proper test equipment.

5.2.1 Test Equipment Required

- DC power supply
- FM signal generator with 6 dB pad
- General purpose oscilloscope
- Solid-state ac voltmeter
- Solid-state dc voltmeter
- Motorola Model S1057B Test Set
- DC ammeter
- MITREK radio (4-frequency) with cable kit, speaker, control module, and appropriate channel elements

5.2.2 Circuit Card Removal

Step 1. Disconnect the two connectors from the rear of the circuit card.

Step 2. Loosen the two captive screws securing the rear housing cover and remove the rear cover.

Step 3. Slide the circuit card out of the housing assembly.

5.2.3 Test Procedure

5.2.3.1 Equipment Set-Up and Current Check

Step 1. Connect the MITREK radio to the control module with its standard cable kit. ("Channel-Scan" monitor circuit board is not connected at this time.)

Step 2. Connect the power supply, speaker, rf signal generator, dc ammeter, microphone, ac voltmeter, and test set.

Step 3. Slowly increase the power supply voltage to 13.8 V dc and note the ammeter reading.

Step 4. Connect the "Channel-Scan" monitor unit as shown on the schematic diagram. Specific detailed wire connections are given in the installation paragraphs of this section.

Step 5. Connect the "Channel-Scan" jumpers as follows:

	JUMPER		
MODEL	JU1-JU8	JU10 or JU11	JU9
Priority	All Connected	JU11 to "PS" Pad	To "S" Pad
Non-Priority	All Removed	JU10 to "S" Pad	To "S" Pad

Step 6. With SCAN off, slowly increase the power supply voltage to 13.8 V dc and note the ammeter reading. Subtract Step 3 current reading from this current reading — the difference should not exceed 180 milliamperes.

Step 7. Press the SCAN switch once to turn the unit on and note the ammeter reading with the radio squelched (no noise heard from the speaker). Subtract Step 3 current reading from this current reading — the difference should not exceed 330 milliamperes.

Step 8. With the "Channel-Scan" unit still on, turn the control module SQUELCH control until the radio set squelches (noise is heard from the speaker). Note the current reading. Subtract Step 3 current reading from this current reading — the difference should not exceed 350 milliamperes.

5.2.3.2 Voltage Regulator Output

Step 1. Measure the voltage from emitter of Q34 to ground with the dc voltmeter. It should be 10 V dc, ± 6%.

Step 2. Measure the voltage across capacitor C31 with the dc voltmeter. It should be 5 V dc, ± 6%.

5.2.3.3 High-Speed Clock Multivibrator Frequency

Step 1. With scan "on" and no rf signal in, set the SQUELCH control so that noise just cuts out (squelches) so that scanning is initiated.

Step 2. With the oscilloscope, observe the waveform on the collector of Q7. Its frequency should be 33 Hz, ± 10% as shown on waveform (18), top trace.

Step 3. Turn the SQUELCH control until noise is heard from the speaker. Scanning should stop.

5.2.3.4 Slow-Speed Clock Multivibrator Frequency and Non-Priority Lock-On

Step 1. Set channel priority as follows:

a. With priority model, press P4.

b. With non-priority model, press NP1 through NP4 and set the control module frequency selector switch to F4.

Step 2. Turn the SQUELCH control until noise from the speaker just cuts out.

Step 3. Set the rf signal generator to the radio set F1 frequency @ 100 microvolts. The unit should lock onto F1 (P1 or NP1 lamp illuminates brightly) and sample F4 (P4 or NP4 "flickers" slightly). Audio is not heard during this test because the rf input signal is not modulated, although it could be.

Step 4. Observe the waveform on the collector of Q24 with an oscilloscope. The frequency should be 4 Hz, ± 20% as shown on waveform (11), top trace.

Step 5. Adjust the signal generator output to the F2 frequency, then F3 frequency @ 100 microvolts. The unit should lock onto F2, then F3, respectively.

Step 6. Select F1 for priority by pressing the P1 switch (priority model) or NP1 through NP4 switches with the control module frequency selector switch set to F1.

Step 7. Set the rf signal generator to the radio set F4 frequency @ 1000 microvolts. The unit should lock onto F4 (P4 or NP4 lamp illuminates brightly) and sample F1 (P1 or NP4 "flickers" slightly).

5.2.3.5 Sampling Time

Step 1. With test equipment set up as in Step 5 of paragraph 5.2.3.4, observe the waveform at the collector of Q29 with an oscilloscope. The channel element sampling period (0 volts) should be greater than 10 milliseconds (see waveform (11)).

Step 2. Disconnect the signal generator. The sampling period at the collector of Q29 (0 volts) should still be greater than 10 milliseconds (see waveform (1)).

5.2.3.6 Priority Lock-On

Step 1. Set channel priority as follows:

a. With priority model; press P4.

b. With non-priority model; press NP1 through NP4 and set the control module frequency selector switch to F4.

Step 2. Connect the signal generator and adjust it to the radio set F4 frequency @ 100 microvolts. The unit should lock on F4 and the P4 or NP4 lamp should light at full brilliance with no "flicker". Repeat this step with F1, F2, and F3 selected as priority.

5.2.3.7 Sensitivity

Step 1. With the "Channel-Scan" monitor switches set as in Step 1 of paragraph 5.2.3.6, set the signal generator output level to zero and turn the SQUELCH control counterclockwise until noise is heard from the speaker.

Step 2. With the ac voltmeter connected to audio output, adjust the control module VOLUME control for 0 dB.

Step 3. Adjust the SQUELCH control until noise is just cut out to initiate high speed scanning.

Step 4. With the signal generator set to F1, slowly increase the output level until noise is heard from the speaker.

Step 5. Observe the ac voltmeter reading. It should be less than -6 dB (non-priority sensitivity).

Step 6. Readjust the signal generator to F4 at minimum output. Do not change previous SQUELCH and VOLUME settings.

Step 7. Slowly increase the signal generator output level until noise is heard from the speaker.

Step 8. Observe the ac voltmeter reading. It should be less than -6 dB (priority sensitivity).

5.2.3.8 Noise Oscillator Frequency

Step 1. With the rf signal generator disconnected, turn the SQUELCH control until noise from the speaker is just cut out.

Step 2. Observe the waveform at the collector of Q33. The frequency should be 15 kHz, ± 3.2 kHz (see waveform (13)).

Step 3. Turn the SQUELCH control until noise is heard from the speaker. The noise oscillator should stop.

5.2.3.9 Muting

Step 1. With no rf signal input, turn the SQUELCH control until noise is heard from the speaker.

Step 2. Set the VOLUME control for 0 dB on the ac voltmeter.

Step 3. Turn the SQUELCH control until noise from the speaker is just cut out and note the ac voltmeter reading. It should be greater than -50 dB.

Step 4. Turn the SQUELCH control until noise is heard from the speaker.

Step 5. Apply 10 volts dc through a 3.3 kilohm resistor to the base of Q30 and observe the ac voltmeter reading. It should be greater than -50 dB down from 4 V.

5.2.3.10 Revert

Step 1. Turn the "Channel-Scan" monitor unit off with the SCAN on-off switch.

Step 2. Connect the "Channel-Scan" monitor jumpers as follows:

	JUMPER		
MODEL	JU1-JU8	JU10 and JU11	JU9
Priority	All Connected	JU11 to "PS" Pad	To "S" Pad
Non-Priority	All Removed	JU10 to "S" Pad	To "S" Pad

Step 3. Set the control module frequency selector switch to the F1 position.

Step 4. Tune the signal generator to F1 @ 1000 microvolts and apply modulation. This signal should be received by the MITREK radio.

5.3 TROUBLESHOOTING INTEGRATED CIRCUITS

Integrated circuits (IC's) are very reliable components and should not be replaced until all checks have proven definitely that the IC is the defective component. Removal of an IC is time consuming and often ruins the part. Therefore, a few extra checks before that task is attempted are worthwhile. Before replacing a bad IC, make sure that the external components in the circuit are normal.

The IC's in the "Channel-Scan" monitor may be checked by dc voltage measurements although signal tracing with an oscilloscope is preferred. Typical dc voltages are shown on the schematic diagram. Waveforms are shown on the waveforms diagram.

If an IC is to be replaced, heat each IC terminal and remove all solder with a "solder sucker" vacuum bulb or use a special IC removing tool.

5.4 REPAIR

Any component on the cirucit card can be replaced by following accepted repair procedures. Refer to the MITREK radio instruction manual for information pertaining to ordering replacement parts. Upon completion of repairs, the circuit card is reinstalled as follows:

Step 1. Disconnect the two connectors from the circuit card.

Step 2. Slide the card completely into the housing.

Step 3. Install the rear housing cover and secure with two captive screws.

Step 4. Reconnect the two connectors to the proper locations.

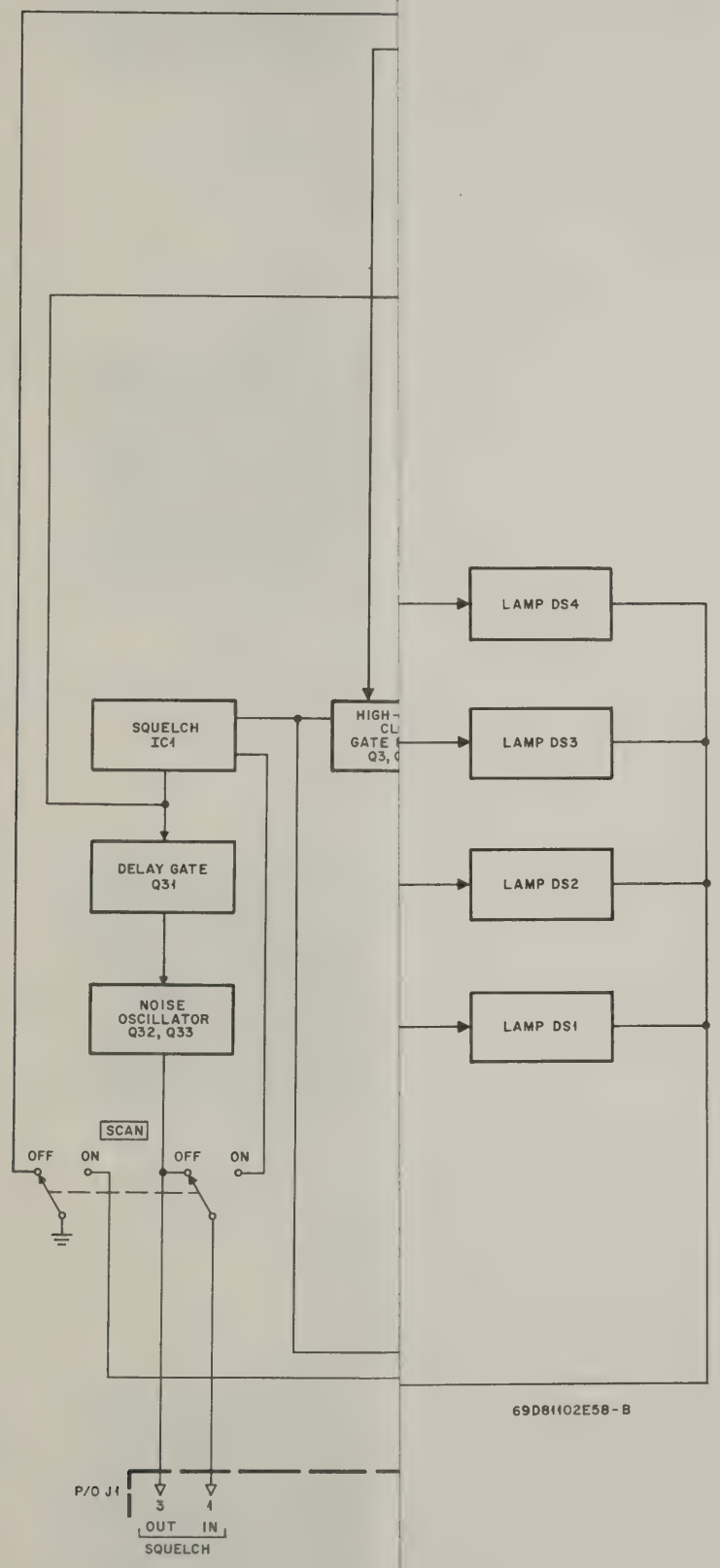


Figure 16.
"Channel-Scan" Monitor Block Diagram

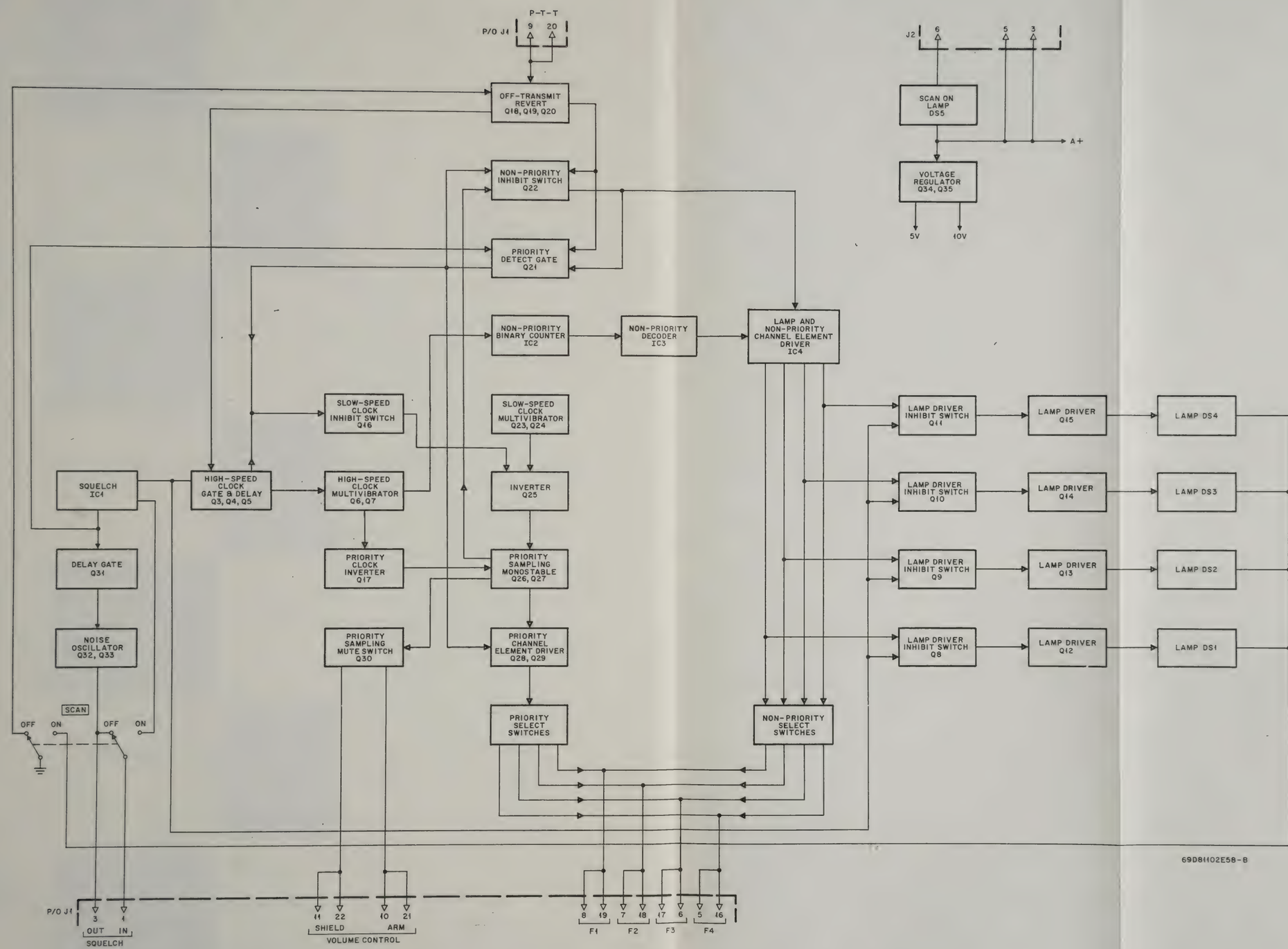
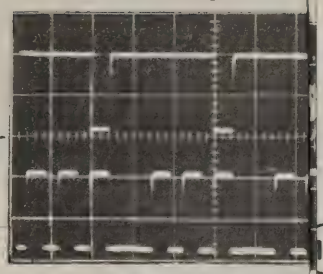


Figure 16.
"Channel-Scan" Monitor Block Diagram

1

NON-PRIORITY CHANNEL ELEMENT BEING SCANNED

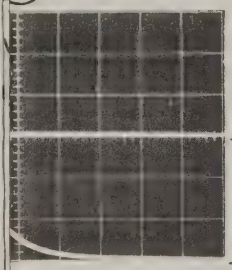
PRIORITY CHANNEL ELEMENT BEING SCANNED



5 V/DIV.
20 MSEC/DIV

NO ON-CHANNEL SIG

17



0

0

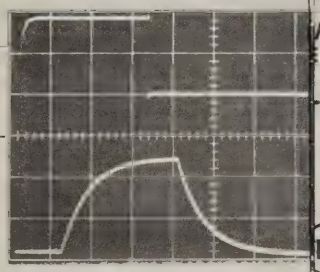
/DIV.
C/DIV.

PRIORITY SIGNAL

5

NON-PRIORITY CHANNEL ELEMENT DURING PRIORITY SAMPLING
5 V/DIV.

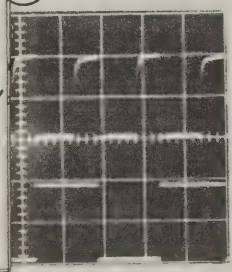
IC1-10
2 V/DIV.



2 MSEC/DIV.

RECEIVED NON-PRIORITY

18



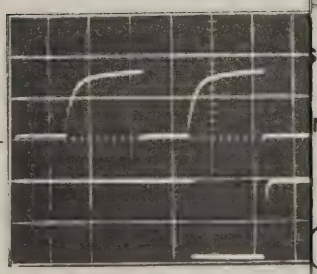
0

0

9

HIGH-SPEED CLOCK (Q7 COL-LECTOR)
2 V/DIV.

NON-PRIORITY CHANNEL ELEMENT BEING SCANNED
5 V/DIV.



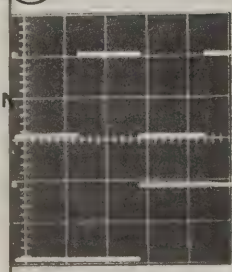
EC/DIV.

NNEL SIGNAL

5 MSEC/DIV.

NO ON-CHANNEL SIGN

19

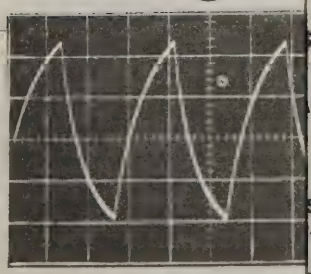


0

0

13

J1-3 NOISE OSCILLATOR OUTPUT



EC/DIV.

NNEL SIGNAL

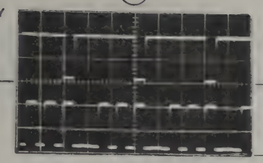
SCANNED
-PRIORITY
SAMPLING
E WITH F3
F4, F3, ETC.

.1 V/DIV.
20 uSEC/DIV.

NO ON-CHANNEL SIGN

EPS-6628-A

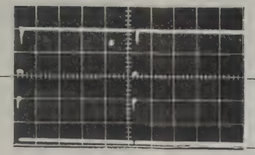
1



5 V/DIV.
20 MSEC/DIV

NO ON-CHANNEL SIGNAL

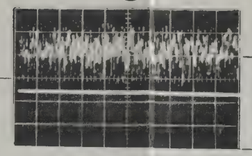
2



5 V/DIV.
50 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

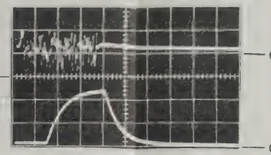
3



5 MSEC/DIV.

NO ON-CHANNEL SIGNAL

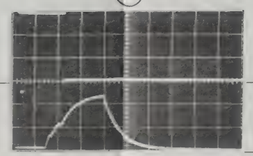
4



2 MSEC/DIV.

PRIORITY SAMPLED DURING RECEIVED NON-PRIORITY SIGNAL

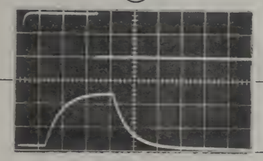
17



2 V/DIV.
2 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

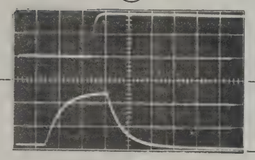
5



2 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

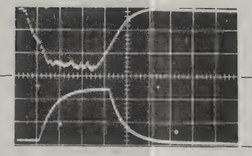
6



2 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

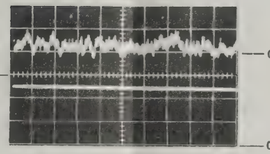
7



2 V/DIV.
2 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

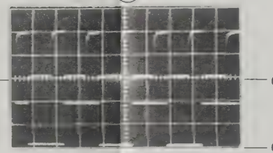
8



2 V/DIV.
5 MSEC/DIV.

NO ON-CHANNEL SIGNAL

18



10 MSEC/DIV.

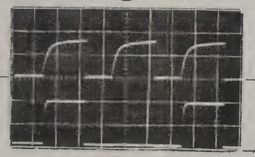
NO ON-CHANNEL SIGNAL

9

5 MSEC/DIV.

NO ON-CHANNEL SIGNAL

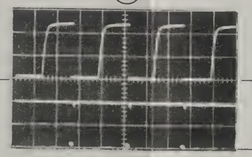
10 *



5 MSEC/DIV.

NO ON-CHANNEL SIGNAL

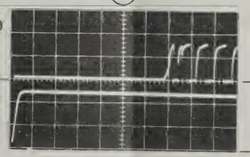
11



100 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

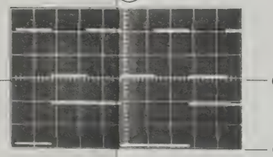
12



2 V/DIV.
20 MSEC/DIV.

ON-CHANNEL SIGNAL LOST

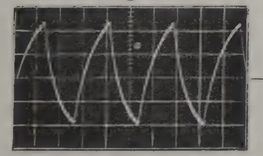
19



10 MSEC/DIV.

NO ON-CHANNEL SIGNAL

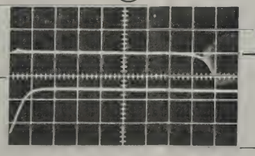
13



.1 V/DIV.
20 uSEC/DIV.

NO ON-CHANNEL SIGNAL

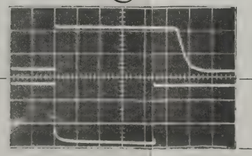
14



5 MSEC/DIV.

ON-CHANNEL SIGNAL LOST

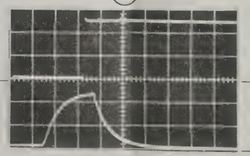
15



5 V/DIV.
100 MSEC/DIV.

P-T-T INPUT

16



2 V/DIV.
2 MSEC/DIV.

RECEIVED NON-PRIORITY SIGNAL

* SHOWS PRIORITY ELEMENT BEING SCANNED DURING TIME INTERVAL WHEN NON-PRIORITY COUNTER AND PRIORITY DRIVER IS SAMPLING CHANNEL SUCCESSIVELY. EXAMPLE WITH F3 AS PRIORITY: F1, F3, F2, F3, F3, F3, F4, F3, ETC.

EPS-6628-A

NOTES:

1. JUMPER JU9 CONNECTS TO

   PRIORITY MODEL - - PAD "S"
   NON-PRIORITY MODEL - - PAD "S", "1", "2", "3", OR "4".
2. JUMPER JU10 CONNECTS TO

   PRIORITY MODEL - - NOT IN
   NON PRIORITY MODEL - - PAD "S", "1", "2", "3", OR "4".

   JUMPER JU11 CONNECTS TO

   PRIORITY MODEL - - PAD "PS"
   NON-PRIORITY MODEL - - NOT IN
3. NP (S1A-S1D) SWITCH ASSEMBLY IS USED WITH NON-PRIORITY MODEL ONLY. THE SWITCHES ARE NOT INTERLOCKED (ALL FOUR MAY BE CLOSED SIMUL TANEOUSLY). P(S2A-S2D) SWITCH ASSEMBLY IS USED WITH PRIORITY MODEL ONLY. ONLY ONE SWITCH MAY BE CLOSED AT A TIME
4. JUMPERS JU1 THRU JU8 ARE CONNECTED IN PRIORITY MODEL ONLY.
5. ALL VOLTAGE MEASUREMENTS ARE REFERENCED TO B- WITH 13.8 V DC APPLIED AND THE CONTROL HEAD SQUELCH CONTROL SET AT THRESHOLD. NON-PRIORITY SWITCHES S1-A THRU S1-D ARE CLOSED. INPUT SIGNAL LEVEL, WHEN APPLIED, IS 100 uV.
   * ——V = UNIT ON OR OFF.

   (——V) = UNIT OFF.

   [——V] = UNIT OFF

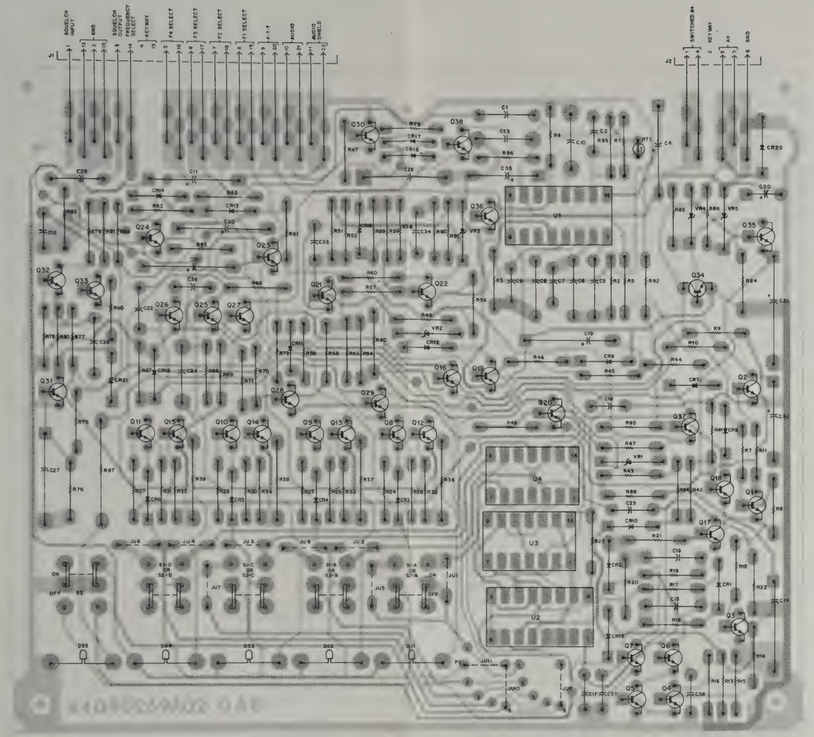
   [——V] = UNIT SCANNING - NO RF CARRIER PRESENT.

   [——V] = UNIT SCANNING - NO RF CARRIER PRESENT.

   [——V] = UNIT RECEIVING A NON-PRIORITY SIGNAL ON F1, F2 SELECTED FOR PRIORITY.

   [——V] = UNIT RECEIVING A PRIORITY SIGNAL ON F2.
6. ALL RESISTOR VALUES ARE GIVEN IN OHMS UNLESS OTHERWISE NOTED. K = KILOHM
7. ALL CAPACITOR VALUES ARE GIVEN IN PICOFARADS UNLESS OTHERWISE NOTED. uF = MICROFARADS.
8. VOLTAGE DEPENDENT ON SIGNAL INPUT. VOLTAGE LOW WITH STRONG SIGNAL, HIGH WITH WEAK SIGNAL.

EPS-27369-A



SHOWN FROM SOLDER SIDE

SOLDER SIDE: RD-EEPS-27370-A
COMPONENT SIDE: RD-EEPS-27370-A
OL-EEPS-27371-A

"Channel Scan" Monitor
Circuit Board Detail
Motorola No. PEPS-27370-A
3/27/79-NPC

parts list

HLN4042A "Channel-Scan" Monitor (Priority)
HLN4043A "Channel-Scan" Monitor (Non-Priority) PL-6124-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 50 V; unless otherwise stated
C1	8-84637L21	0.15; 100 V
C2	21-84715E35	200 pF ± 5%
C4	23-83214C15	4.7 ± 20%; 25 V
C5	8-83813H28	.01 ± 5%; 100 V
C6	8-82905G07	0.1
C7	21-80067A65	100 pF ± 5%; 200 V
C8	8-83813H28	.01 ± 5%; 100 V
C9	21-82428B28	.002; 100 V
C10	8-84637L22	0.22; 100 V
C11	23-82783B16	2.2; 15 V
C12	21-82372C04	.05 + 80-20%; 25 V
C13	8-84637L22	0.22; 100 V
C14	23-82783B27	10; 25 V
C15, 16	8-82905G31	0.15
C17, 18	21-832501	.01 + 60-40%; 250 V
C19	23-865137	4.7
C20, 21	23-82783B16	2.2; 15 V
C22, 23	8-82905G02	.022; 100 V
C24	8-84637L22	0.33; 100 V
C25	8-84637L39	0.39; 100 V
C27	23-83214C15	4.7 uF
C28	8-82905G40	.030
C29	21-82372C09	0.1 + 80-20%; 25 V
C30	23-84538G06	47 ± 20%; 20 V
C31	23-83214C02	15 ± 20%; 25 V
C32	23-83214C17	3.3 uF ± 20%; 15 V
C33	21-832501	.01 + 60-40%; 250 V
C34	8-84637L02	.033 ± 5%
C35	23-84762H08	3.9 ± 20%; 15 V
C36, 37, 38	21-82428B28	.002; 200 V
		semiconductor device, diode: (see note)
CR1 thru 19	48-83654H01	silicon
CR20	48-82466H13	silicon
CR21	48-83654H01	silicon
		light, indicator:
DS1 thru 5	65-84047E01	includes light diffuser and 10-volt lamp
		integrated circuit: (see note)
IC1	51-84267A09	type M6709
IC2	51-84084D15	type M84D15
IC3	51-84084D20	type M84D20
IC4	51-84084D21	type M84D21
		connector, receptacle:
J1		consists of contact terminals mounted on edge of circuit board, as follows: 28-84269C01 TERMINAL, contact; narrow mounting tab (lower row) 28-84269C02 TERMINAL, contact; wide mounting tab (upper row)
J2		consists of contact terminals mounted on edge of circuit board, as follows: 28-84269C01 TERMINAL, contact; narrow mounting tab (lower row) 28-84269C02 TERMINAL, contact; wide mounting tab (upper row)
		connector, plug:
P1		includes: 14-84556B06 BODY; numbered 1 thru 22 9-84151B01 TERMINAL, contact; female
P2		includes: 14-84590B01 BODY; numbered 1 thru 6 9-84151B01 TERMINAL, contact; female
		transistor: (see note)
Q1 thru 11	48-869570	NPN; type M9570
Q12 thru 15	48-869571	PNP; type M9571
Q16 thru 18	48-869570	NPN; type M9570
Q19	48-869571	PNP; type M9571
Q20	48-869567	NPN; type M9567
Q21 thru 26	48-869570	NPN; type M9570
Q27	48-869571	PNP; type M9571
Q28	48-869570	NPN; type M9570
Q29	48-869567	NPN; type M9567
Q30	48-869528	NPN; type M9528
Q31 thru 33	48-869570	NPN; type M9570
Q34	48-869428	NPN; type M9428
Q35	48-869568	NPN; type M9568
Q36	48-869570	NPN; type M9570
Q37	48-869642	NPN; type M9642
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-124A82	24k
R2	6-124A43	560
R3	6-124A51	1.2k
R4	6-124B04	180k
R5	6-124A81	22k
R7, 8	6-124A81	22k
R9, 10	6-124A65	4.7k
R11, 12	6-124A49	1k
R13, 14, 15	6-124A91	56k
R16	6-124A89	47k
R17	6-124A73	10k
R18, 19	6-124A91	56k
R20	6-124A73	10k
R21	6-124A83	27k
R22	6-124A73	10k
R23 thru 27	6-124A49	1k
R28 thru 31	6-124A51	1.2k
R32 thru 35	6-124A73	10k
R36 thru 39	6-125A29	150, 1/2 W
R40	6-124B02	150k
R41, 42	6-124A81	22k
R43	6-124A89	47k
R44	6-124A01	10
R45, 46	6-124A81	22k
R47	6-124A65	4.7k
R48	6-124A83	27k
R49	6-124A65	4.7k
R50	6-124A73	10k
R51, 52	6-124A89	47k
R53	6-124A65	4.7k
R54	6-124A89	47k
R55, 56	6-124A73	10k
R57	6-124A65	4.7k
R58	6-124A73	10k
R59	6-124A89	47k
R60	6-124A65	4.7k
R61	6-124A73	10k
R62, 63	6-124A93	68k
R64	6-124A73	10k
R65	6-124A83	27k
R66	6-124A73	10k
R67	6-124A97	100k
R68, 69, 70	6-124A73	10k
R71	6-124A89	47k
R72	6-124A65	4.7k
R73	6-124A61	3.3k
R74	6-124A83	27k
R75	6-124A85	33k
R76	6-124A73	10k
R77	6-124A33	220
R78	6-124A41	470
R79	6-124A49	1k
R80	6-124A61	3.3k
R81	6-124A31	180
R82	6-124A61	3.3k
R83	6-124A50	1.1k
R84	6-124A11	27
R85	6-131276	150
R86	6-124A49	1k
R87	6-126C31	180 ± 10%; 1 W
R88	6-124A93	68k
R89	6-124A89	47k
R90	6-124A83	27k
R91, 92, 93	6-124A89	47k
R94	6-124A81	22k
R95	6-124A85	33k
		thermistor:
RT1	6-83600K08	20k @ 25°C
		switch assembly, push: (non-priority)
S1	40-84324C05	4 independent sections; each section "push-to-actuate, push-to-return"; consists of
S1A		2 form "C"
S1B		2 form "C"
S1C		2 form "C"
S1D		2 form "C"
S2	40-84324C09	4-section; interlocking; with lockout; consists of:
S2A		2 form "C"
S2B		2 form "C"
S2C		2 form "C"
S2D		2 form "C"
S3	40-84324C01	single-section; "push-to-actuate, push-to-return"; 2 form "C"
		voltage regulator: (see note)
VR1, 2, 3	48-82256C15	Zener type; 5.1 V
VR4	48-82256C03	Zener type; 4.7 V
VR5	48-82256C12	Zener type; 5.6 V
		non-referenced items
	38-84321C01	PUSHBUTTON (shadow pearl)
	38-84321C02	PUSHBUTTON (orange)
	38-84617C01	SPACER, pushbutton lockout
	66-84699B01	CONTACT REMOVAL TOOL
	13-84319C11	ESCUTCHEON (priority)
	13-84319C09	ESCUTCHEON (non-priority)
	14-84360C01	INSULATOR, switch; 5 used
	14-84006D01	SPACER, switch
	26-84018B01	HEAT SINK, transistor
	4-483513	WASHER, insulating
	42-10217A02	STRAP TIE; 2 used
	4-483513	WASHER, insulator

note: For optimum performance, replacement diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

REFERENCE SYMBOL	MOTOROLA PART NUMBER	DESCRIPTION
R11, 12	6-124A49	1k
R13, 14, 15	6-124A91	56k
R16	6-124A89	47k
R17	6-124A73	10k
R18, 19	6-124A91	56k
R20	6-124A73	10k
R21	6-124A83	27k
R22	6-124A73	10k
R23 thru 27	6-124A49	1k
R28 thru 31	6-124A51	1.2k
R32 thru 35	6-124A73	10k
R36 thru 39	6-125A29	150; 1/2 W
R40	6-124B02	150k
R41, 42	6-124A81	22k
R43	6-124A89	47k
R44	6-124A01	10
R45, 46	6-124A81	22k
R47	6-124A65	4.7k
R48	6-124A83	27k
R49	6-124A65	4.7k
R50	6-124A73	10k
R51, 52	6-124A89	47k
R53	6-124A65	4.7k
R54	6-124A89	47k
R55, 56	6-124A73	10k
R57	6-124A65	4.7k
R58	6-124A73	10k
R59	6-124A89	47k
R60	6-124A65	4.7k
R61	6-124A73	10k
R62, 63	6-124A93	68k
R64	6-124A73	10k
R65	6-124A83	27k
R66	6-124A73	10k
R67	6-124A97	100k
R68, 69, 70	6-124A73	10k
R71	6-124A89	47k
R72	6-124A65	4.7k
R73	6-124A61	3.3k
R74	6-124A83	27k
R75	6-124A85	33k
R76	6-124A73	10k
R77	6-124A33	220
R78	6-124A41	470
R79	6-124A49	1k
R80	6-124A61	3.3k
R81	6-124A31	180
R82	6-124A61	3.3k
R83	6-124A50	1.1k
R84	6-124A11	27
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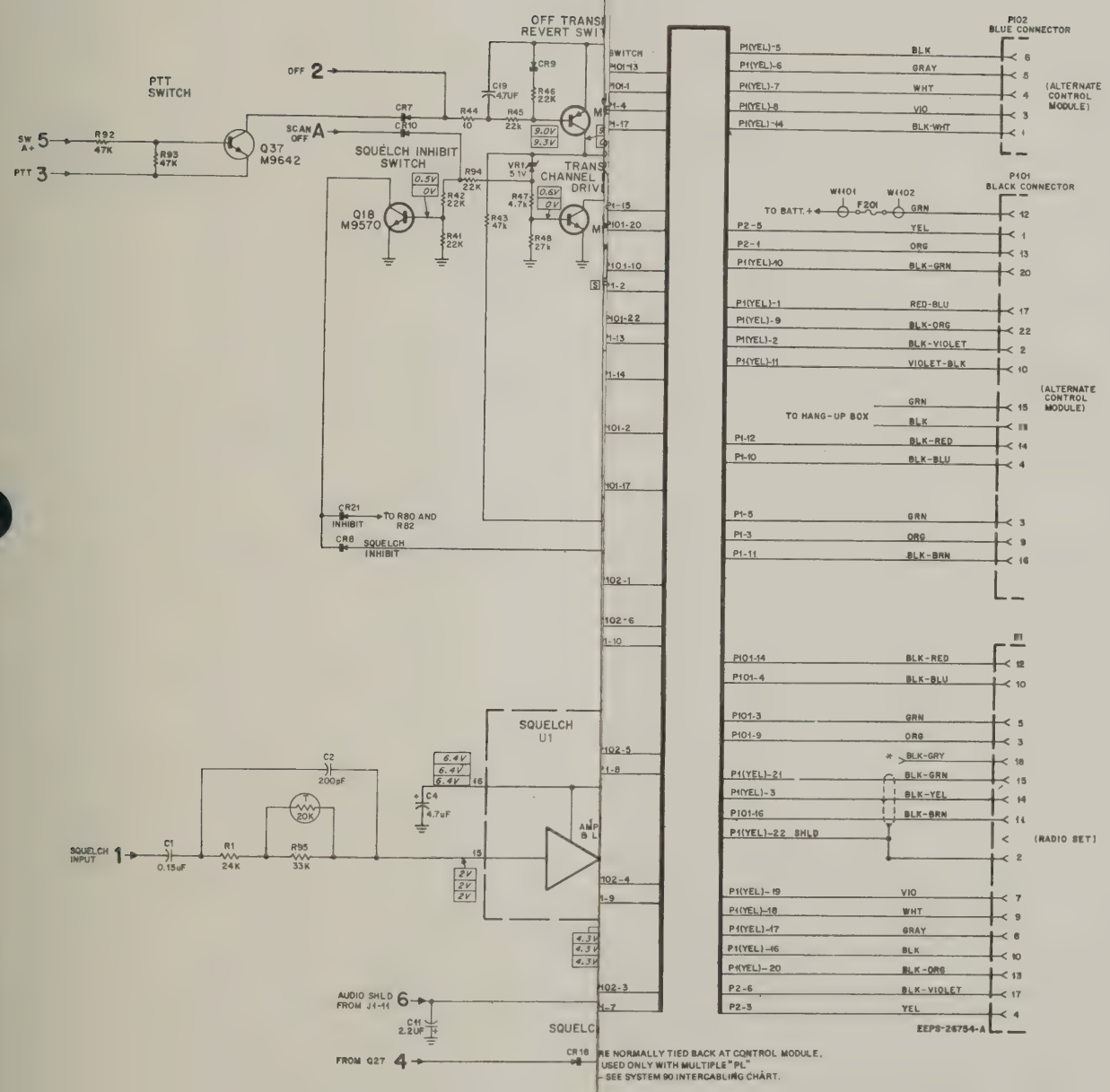
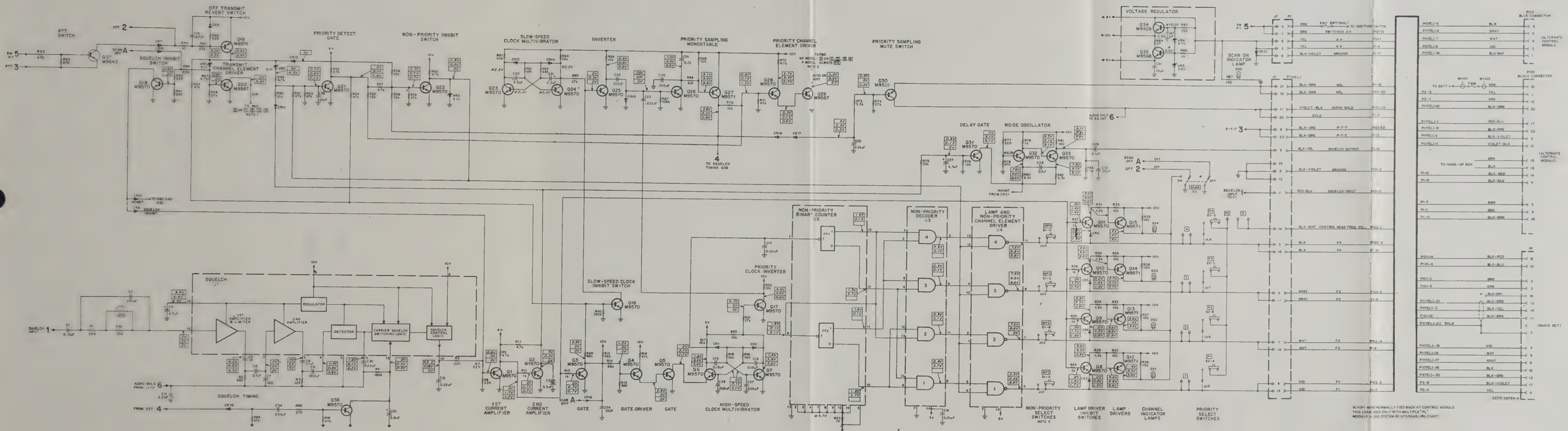


"Channel-Scan" Monitor
Schematic Diagram
Motorola No. EEPS-26754-A
3/27/79-NPC



"Channel-Scan" Monitor
Schematic Diagram
Motorola No. EEPS-26754-A
3/27/79-NPC

MITREK SYSTEMS 90
Channel Scan Monitor
Models HLN1002A, HLN1003A

68P81109E58-A